Chapter One: General Introduction Guide

1.1. General Introduction

The Smart Mars MS high frequency on-line UPS series, adopting 50KHz High-frequency topology and integrating with micro-processor based central Control circuit and smart RS232 communication, offers extremely high industrial Grade protection, user-friendly interface for a wide range of application.

1.1.1. The General Characteristics

- True online architecture continuously supplies in your critical device with a stable, regulated, transient-free pure sine-wave AC Power.
- 50KHz PWM sine-wave topology yields an excellent overall performance.
- The high crest factor of the inverter handles all high-inrush current loads without a need to upgrade the power rating.
- To protect the unit from overloading, it automatically switches to bypass mode in case loading exceeds 120% of rating. It will automatically switch back to inverter mode once overload condition ceases.
- Should the output becomes short-circuited, the UPS holds the system and cuts the output automatically till the short circuit situation is removed.
- Should the unit become overheated, the internal thermistor will detect the heat and switch to bypass mode and vice versa.
- Maintenance-free sealed-type battery minimizes after-sales service.

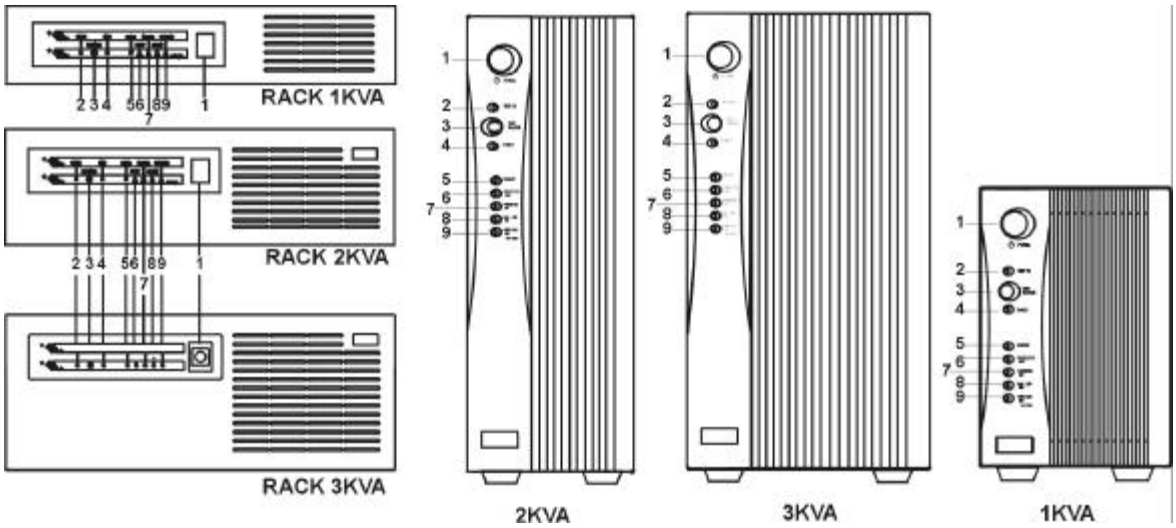
1.1.2. The Advanced Technical Characteristics

- Market leading light and compact design for modern OA environment and OEM flexibility.
- Powerful CPU integrates all power stages, control and communication functions necessary for maximized UPS protection and functionality, including Power management status monitoring, configuration setting operation Scheduling, remote control and self-diagnosis.
- Slick CPU communication design allows full function remote control from any computer environment via standard RS-232 interface using Megatec's RUPSII protocol.
- State-of-the-Art IGBT Technology and Industrial Grade quality ensures Highest efficiency and reliability under worst operating condition.
- Industry lading inverter protection technology incorporates 2-stage output Current sensor, smart overload output current control, improved crest factor, and feedback failure proof circuit, elevating the availability of power service.
- Guarantees an exclusive protection against DC damage for inductive load, Such as motor based devices, entirely eliminating application limitation.
- Advanced Input PFC control guarantees the PF performance and maximum energy efficiency.
- Unique electronic over-current protection detects output short-circuit and faults, and halts output before damages done to output fuse or equipment, thereby minimizing the need for service.
- Expanded input voltage working range minimizes battery usage and enhances battery utilization and life.
- Automatic Frequency Sensor reduces headache in frequency shift.
- DC-start function makes sure of the start-up of UPS during power outages.
- On-demand self-diagnosis function ensures UPS reliability and availability.
- Built-in supplementary charger enables speediest charging of external battery Bank.
- SNMP adapter slot represents the advanced upgrade solution to achieve direct power management via internet world-wide.
- User's adjustable Output DIP switches allow you to select an accommodate Output voltage for your critical device.

1.2. System Layout and Description

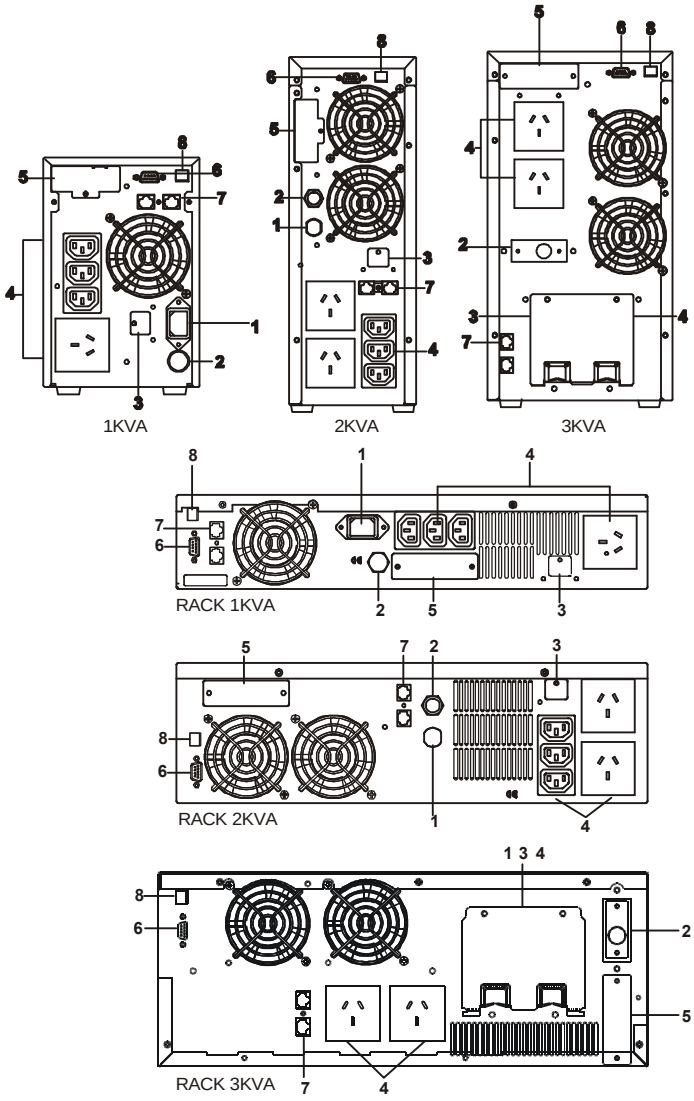
1.2.1. Front Panel and Rear Panel Layout

1.2.1.1. Front Panel Explanation



1.	**Main Switch**	This is control the on/off of the UPS
2.	**Self Test OK LED**	Green LED lights up if self test is O.K.
3.	**Test/Silence**	a. To silence alarm by pressing the button. **b.1.For Standard Unit** To execute the self test of the UPS by pressing the button over 10 sec. **b.2.For Unit with Manual Bypass function (Special order required)** To press the button over 5 seconds, the UPS will be switched to Bypass mode and vice versa. c. To illustrate the percentage of output load level at AC Mode, and the battery energy level at Backup Mode by pressing the button.
4.	**Fault LED**	Red LED lights up if UPS is faulty.
5.	**Inverter LED**	a. Inverter On: Green LED light up b. 75% for load & battery level.
6.	**Utility LED**	a. AC normal: Green LED lights up. b. 100% for load & battery level
7.	**Bypass LED**	Amber LED lights up when UPS is in Bypass mode.
8.	**Battery low LED**	a. Battery low :Red LED lights up b. 50% for load & battery level
9.	**Over load LED**	a. Over load condition: Red LED lights up b. 25% for load & battery level.
10.	**Load Level LED's**	Push the Test/Silence button for few seconds when Utility is normal, the LED's combined by Utility, Inverter, Battery Low, Overload LED's will show you the load percentage connected.
11.	**Battery Level LED's**	Push the Test/Silence button for few seconds when Utility Is abnormal, the LED's combined by Utility, Inverter, Battery Low and Overload LED's will show you the percentage of the battery energy left.

1.2.1.2. *Rear Panel Explanation*



1)	AC Inlet	This is to be connected with an AC power cord for plugging into the wall receptacle.			
2)	AC Input Fuse	This is to disconnect line input to protect application from Output overload or short circuit.			
		Fuse Rating for120Vac			
		MS1K/MS1KR	MS2K/MS2KR	MS3K/MS3KR	
		20A/250V	25A/250V	50A/250V	
		Fuse Rating for 230Vac			
		MS1K/MS1KR	MS2K/MS2KR	MS3K/MS3KR	
		10A/250V	15A/250V	25A/250V	
3)	External Battery Terminal	This is a battery terminal to be connected with additional battery banks for longer backup time purpose. Only a qualified technician is permitted to proceed the installation.			
4)	AC Outlet (for230Vac)	This is to be plugged by the devices being protected by the UPS.			
		Socket Type	MS1K/MS1KR	MS2K/MS2KR	MS3K/MS3KR
		IEC	3pcs	3pcs	N/A

		Local Sockets	1pce	2pcs		2pcs
		Terminal Block	N/A	N/A		Terminal
	AC Outlet (for120Vac)	Socket Type	MS1K/ MS1KR	MS2K	MS2KR	MS3K/MS3KR
		NEMA5-15R	4pcs	4pcs	2pcs	N/A
		NEMA5-20R	N/A	1pce	1pce	N/A
		NEMA5-30R	N/A	N/A	N/A	1pce
		Terminal Block	N/A	N/A	N/A	Yes
5)	SNMP Slot	It is an optional feature used for SNMP card.				
6)	Comm Port	This is an interface to send signals to and receive signals from the computer. An optional computer software may be required.				
7)	RJ11/RJ45 Jack	This is to offer you a modem/internet (RJ11) and 10-Base T Network(RJ45) protection against line interference.				
8)	DIP Switches	1. For early version of CPU, Setup the output voltage according to the table below.				

Dip / Vac	3	4
100V/200Vac	Off	On
110V/220Vac	Off	Off
115V/230Vac	On	Off
120V/240Vac	On	On

2. For new version of CPU, the DIP Switch can be used for Calibration only. Not for output voltage selection.

1.3. Communication Port Explanation

The communication port on the rear panel of the UPS is a *true RS232 serial type*. It may be connected to a computer and allows the computer to monitor the status of UPS, and controls the operation of the UPS, via an additional UPS software kits. The bundled software of the UPS is for Windows environment, such as Windows 3.1, Windows 95 & 98, Windows NT. For other applications, such as Novell NetWare, Unix, etc., please contact your local distributor for a proper solution.

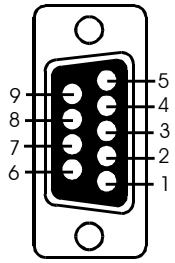
1.3.1. The RS232 interface settings

The RS232 interface shall be set as follows:

Baud Rate	**: 2400 bps**
Data Length	**: 8 bits**
Stop Bit	**: 1 bit**
Parity	**: None**

1.3.2. The Pin Assignments of true RS232 type

The Pin Assignments of true RS232 type are illustrated as follows:



Pin 6: RS232 Rx

Pin 9: RS232 Tx

Pin 7: Ground

Chapter Two: System Block Diagram

Basically, the Mars MS series are composed of Logic Board, Driver Board, And Display Board.

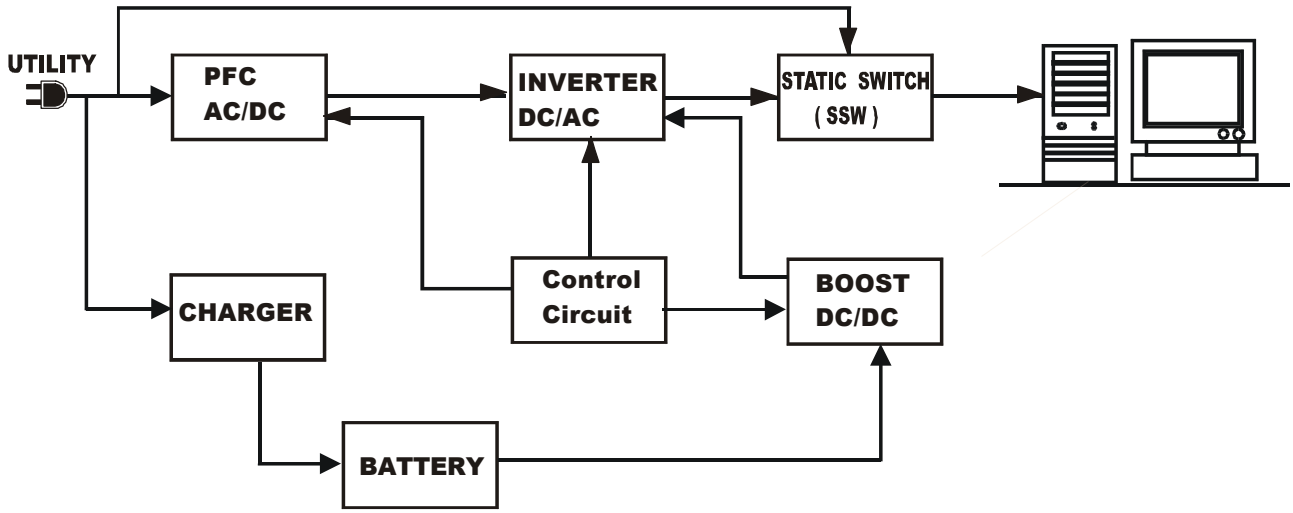
2.1. PC Boards and Their Functions Explanation

The Mars MS series is composed of three major boards, of which functions are Explained as follows:

Item	Board	Part No.	Main Functions
1.	Control Logic	MS1K, MS2K & MS3K: MSI9919-x 或 MSAIxxx	Control Logic Circuit, Sine Wave Generator , Detecting & protection feedback circuit and communication circuit.
2.	Driver	MS1K:MS-D9917-x MSADxxx MS2K:MS-D9910-x MSBDxxx MS3K:MSCD0xx MSCDxxx	Charging circuit, UPS Working Source Circuit, Input Power Factor Correction Circuit, DC to AC Converter circuit, and DC Booster circuit.
3.	Display	MS-M9920-x	Circuits for LED indicators

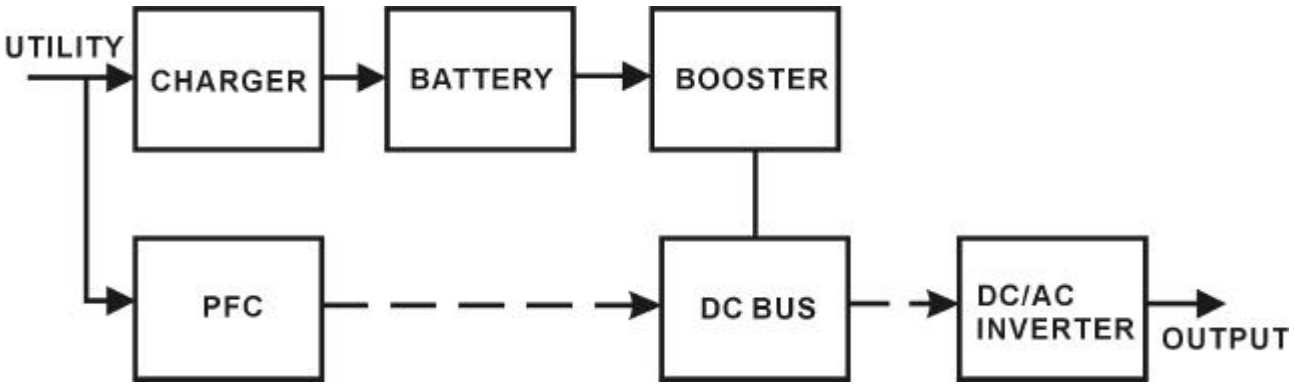
2.2. Control Logic Board Block Diagram

The main circuit of Logic board is simply separated into Twelve major Sections as shown in the below, which mainly include AC Input & Inverter Phase Detect circuit, Phase Lock Loop(PLL) circuit, PWM Generator Loop, Output Current Limit circuit, Short Circuit Detect circuit, Feed Back Fault Detect circuit, Inverter Over-current detect circuit, Battery Voltage detect circuit, Output current Detect circuit, AC input Blackout circuit, and Communication Interface circuit. A block diagram is illustrated as follows:



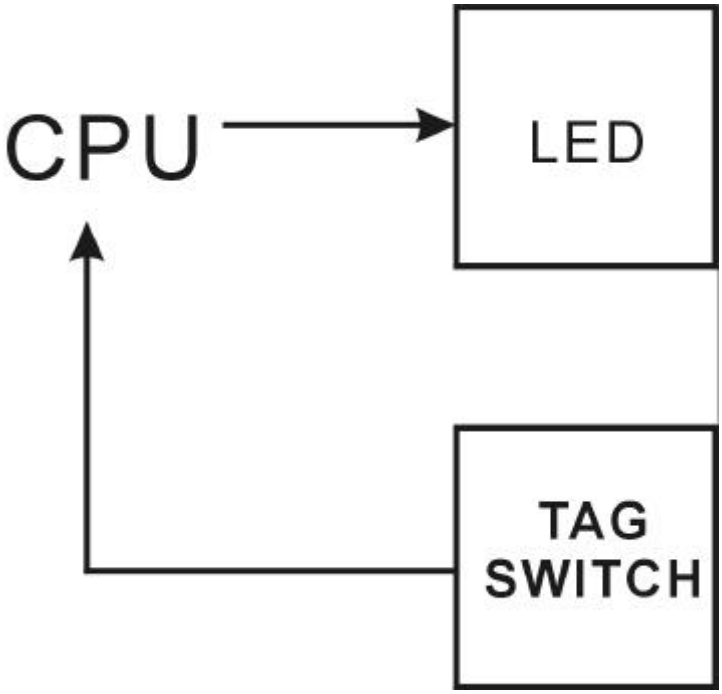
2.3. Driver Board Block Diagram

The circuitry of Driver Board can mainly divided into five sections. They are Charger circuit, UPS System Source Circuit, Input Power Factor Correction Circuit, DC to AC Converter Circuit and DC Booster circuit. A block diagram is illustrated as follows:



2.4. Display Board Block Diagram

The circuitry of Display board can mainly be divided into two sections; one is the display of LED and the other is the function keys. A block diagram is illustrated as follows:



Chapter Three: Field Calibration Guide

3.1. Introduction

There are several variable resistors(SVR or potential-meter) and jumpers on the PCB. They are used for the adjustments of set points which vary from different electrical applications.

3.2.Tools Required

Tools	**Description**
1. AC Source	: To offer an input power 100/110/120 or 220/230/240Vac to the UPS.
2. Multi Meter	: To measure the Input Voltage and Battery Voltage of the UPS
3. Power Meter	: To measure the Output Voltage and Output Power of the UPS.
4. Resistance Load	: Bulb Fixture(700W/1400W/2100W)
5. Screw Driver	: flat-type, cross-type

3.3. Technical Data

3.3.1. Battery Charging Voltage(25 C)

Set point / Model	**Battery Charging Voltage**
1. MS1K	41.4VDC +/-0.5V
2. MS2K	82.8VDC +/-0.5V
3. MS3K	110.4VDC +/-1.2V

3.3.2. Setpoints for Battery Low and Battery Cutoff

Model	**Battery Low**	**Battery Cutoff**
1. MS1K	32.4V +/-0.5VDC	28.8+/-0.5VDC
2. MS2K	64.8V +/-0.5VDC	57.6V +/-0.5VDC
3. MS3K	86.4V +/-0.5VDC	76.8V +/-0.5VDC

3.3.3. Fuse Rating(for Standard Models)

Model No.#	**MS1K/MS1KR**	**MS2K/MS2KR**	**MS3K/MS3KR**
DC Fuse	40A/20A*2	20A*2	20A*2
AC Fuse for 230Vac	10A/250V	20A/250V	25A/250V
AC Fuse for 120Vac	20A/250V	25A/250V	50A/250V

3.4. Test Point Default Value

a. Control Logic Board: MS-I9919-x			
Jumper			Functions
JP1			Reserved
JP2			Reserved
JP3			Output Voltage Calibration
JP4(Default: Open for Internal Charger)			Internal/External Charger Selection
JP5			Reserved
Driver Board:			
1K(MS9917-X)	2K(MSBD-X)	MS3K(MSCD-x)	Functions
JP1	JP2	JP1	Manual PFC Start-on Switch
JP2	JP1	JP3	Over-temperature Protection
JP3	JP3	JP2	Manual DC Booster Switch

3.5. Jumper Functions Explanation

a. Control Logic Board: MS-I9919-x		
Jumper		Functions
JP1		Reserved
JP2		Reserved
JP3		Output Voltage Calibration
JP4(Default: Open for Internal Charger)		Internal/External Charger Selection
JP5		Reserved
Driver Board:		
MS-D9917-x for 1K & 2K	MSCD0xx for 3K	Functions
JP1	JP1	Manual PFC Start-on Switch
JP2	JP3	Over-temperature Protection
JP3	JP2	Manual DC Booster Switch

3.6. Channel Function Explanation

Driver Board

MS1K	MS2K	MS3K	Function
CN1	CN3	CN3	Connection with Logic Board
CN2	CN4	CN4	To Main Switch
CN3	CN1, CN2	CN1, CN2	To Fan
CN4	CN10	CN6	To the negative part of battery
CN5	CN9	CN5	To the positive part of battery
CN6	CN8	CN10	O/P Line
CN7	CN6	CN8	I/P AC Source Line
CN8	CN5	CN7	1.I/P AC Source Neutral 2.External Charger I/P Neutral
CN9	CN7	CN9	O/P Neutral
CN10	CN6	CN8	External Charger I/P Line
CN11			Reserved

3.7 VR Calibration and Switch Setting Procedure

3.7.1 VR/Switch Function Explanation

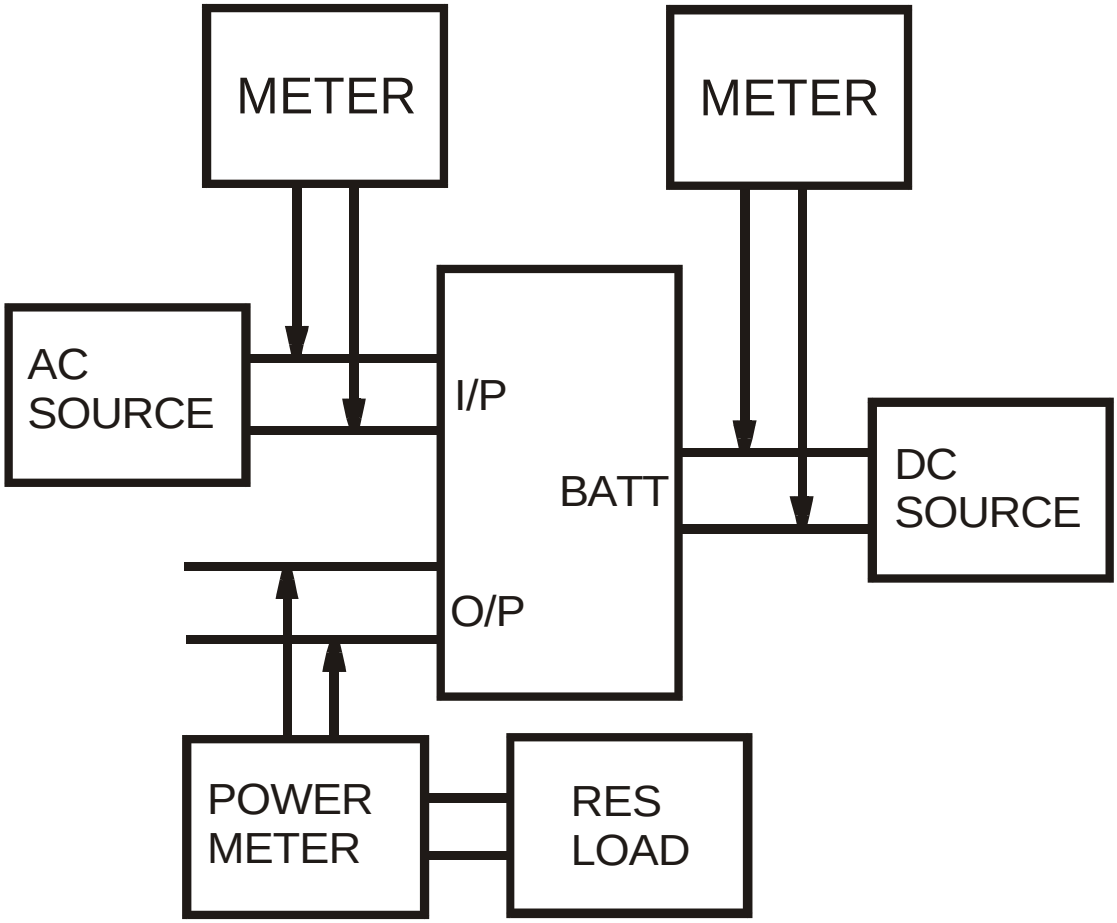
3.7.1.1 VR Function Explanation

VR / Adjustment	MS1K(R)/2K(R)/3K(R)
A. Logic Board: MS-I9919-x	
O/P Voltage Balance	VR1
Output Voltage Selection	SW1
CPU Reset	SW2
B. Driver Board: MSD9917-x or MSADxxx for 1K; MSD9910-x or MSBDxxx for 2K; MSCDxxx for MS3K	
Charger Output Voltage	VR1

3.7.2. Setting Procedure

3.7.2.1. Equipment Installation

Please connect the equipment mentioned in 3.2. as the drawing Shown in the below:



3.7.2.2. Setting Procedure for EARLY version of CPU (MS01013F、MS03014B and those before MS0731)

1. *Short the JP3 of the control board by jumper cap. Do Not Connect Battery.*
2. *Add 110V/60Hz or 220V/50Hz and Adjust Charger Voltage: 41.4V for MS1K/MS1KR, 82.8V for MS2K/MS2KR and 110.4V for MS3K/MS3KR. (Important: The input voltage must be precisely110V/60Hz or 220V/50Hz)*
3. *Switch on the front switch of the UPS and adjust the output voltage to Desired one. To decrease or increase the voltage, please follow the chart below:*

Output Voltage Adjustment	*DIP SW1*	*DIP SW2*	*DIP SW3*	*DIP SW4*
Decrease O/P Voltage	*OFF*	*OFF*	*OFF*	*OFF*
Increase O/P Voltage	*OFF*	*ON*	*OFF*	*OFF*
Remarks: to enable the adjustment, please push the Test Switch to Increase or decrease the voltage till the desired one.				

4. *Set the DIP SW1 ON and DIP SW2 OFF, then add a resistance load Of 700W, 1400W and 2100W for MS1K/MS1KR, MS2K/MS2KR, And MS3K/MS3KR respectively. Read the input voltage and battery Voltage from the multi-meters connected to see whether they are at The desired 110Vac or 220Vac and 41.4V/82.8V/110.4Vac.*

5. *Then, push the Test Switch to see whether the voltage setting is done Successfully.*

Tolerance of Input Voltage	*CPU Action*	*Setup Condition*
CPU Read Value <10%	*CPU automatically adjusts and Buzzer beeps twice.*	*Success*
CPU Read Value>10%	*Buzzer beeps continuously*	*Failure*
Remarks: If the setup is in failure, you shall proceed the adjustment all over again Or return for repair.		

6. *Switch off the UPS and remove the jumper cap from the JP3.*
7. *To choose the model type and output voltage, adjust the DIP Switch 3-4 at the rear part of logic board , following the tables below:*

Voltage	*100/200Vac*	*110/220Vac*	*115/230Vac*	*120/240Vac*
DIP-SW3	*OFF*	*OFF*	*ON*	*ON*
DIP-SW4	*ON*	*OFF*	*OFF*	*ON*

8. *In most of cases，The Calibration Procedure is NOT nessary, even after replace CPU and Logic Board.*
9. *For a UPS already been set, when doing procedure 4, the load is not necessary.*

3.7.2.3. Setting Procedure for NEW version of CPU

1.Short the JP3 of the control board by jumper cap. Do Not Connect Battery.

2.Add 110V/60Hz or 220V/50Hz and Adjust Charger Voltage: 41.4V for MS1K/MS1KR, 82.8V for MS2K/MS2KR and 110.4V for MS3K/MS3KR. (Important: The input voltage must be precisely110V/60Hz or 220V/50Hz)

3.Software Setting(This part is not nessary if the UPS already been set)。

4.Switch on the front switch of the UPS and adjust the output voltage to 220V/110V. To decrease or increase the voltage, please follow the chart below:

Output Voltage Adjustment	*DIP SW1*	*DIP SW2*	*DIP SW3*	*DIP SW4*
Decrease O/P Voltage	*OFF*	*OFF*	*OFF*	*OFF*
Increase O/P Voltage	*OFF*	*ON*	*OFF*	*OFF*
Remarks: to enable the adjustment, please push the Test Switch to Increase or decrease the voltage till the desired one.				

5.Set the DIP SW1 ON and DIP SW2 OFF, then add a resistance load Of 700W, 1400W and 2100W for MS1K/MS1KR, MS2K/MS2KR, and MS3K/MS3KR respectively. (For an UPS already been set, the load is not nessary) Read the input voltage and batteryVoltage from the multi-meters connected to see whether they are at the desired 110Vac or 220Vac and 41.4V/82.8V/110.4Vac.

6.Then, push the Test Switch to see whether the voltage setting is done Successfully.

Tolerance of Input Voltage	*CPU Action*	*Setup Condition*
CPU Read Value <10%	*CPU automatically adjusts and Buzzer beeps twice.*	*Success*
CPU Read Value>10%	*Buzzer beeps continuously*	*Failure*
Remarks: If the setup is in failure, you shall proceed the adjustment all over again Or return for repair.		

7.Switch off the UPS and remove the jumper cap from the JP3.

8.In most of cases，The Calibration Procedure is NOT nessary, even after replace CPU and Logic Board.

9.For the new versions of CPU, output voltage is selected by software(step 3).

Chapter Four: Trouble Shooting Guide For MS1K

4.1. Utility is Normal, but UPS on Battery Mode

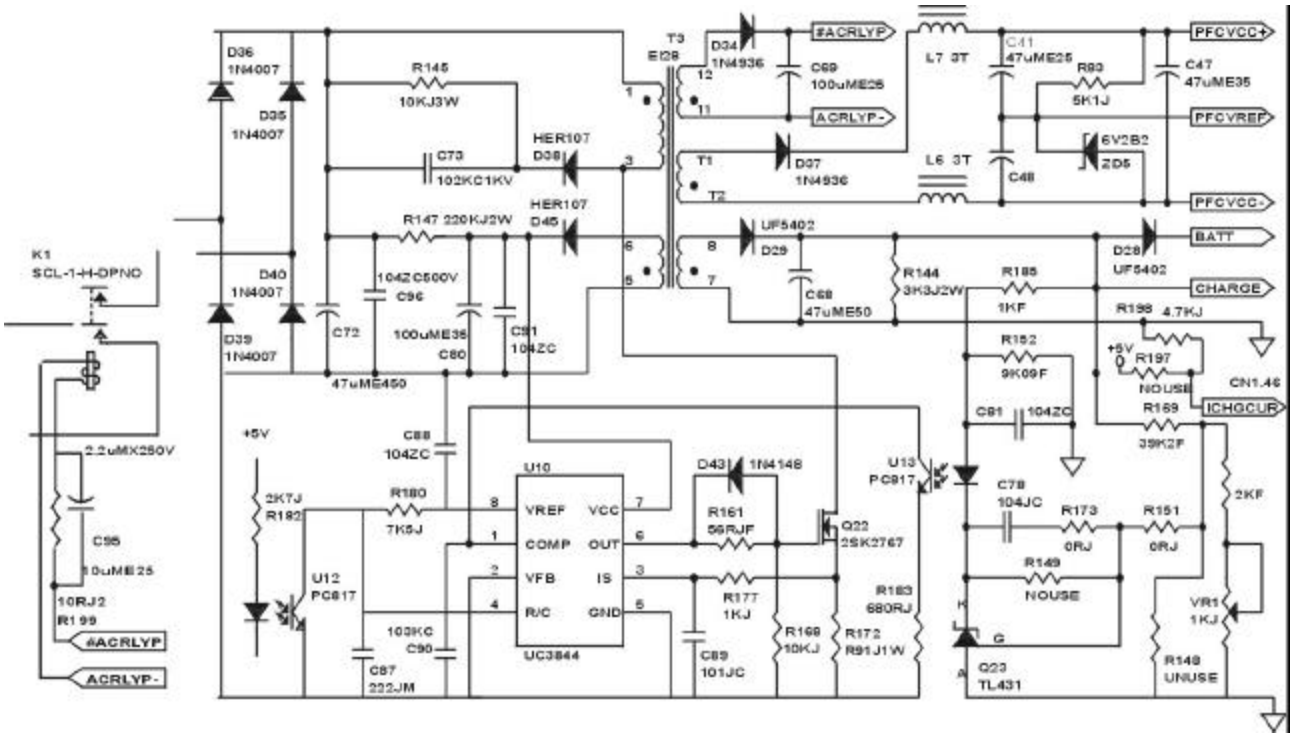


FIG. 4.1

Check Items	***Trouble-shooting***
Utility Voltage is out of windows(<80Vac or >140Vac for 120Vac system;160Vac or >280Vac for 230Vac system)	Your Utility quality is too bad. You are recommended to install an AVR in front of the UPS.
Input AC fuse is broken.	Replace a new fuse with same rating one.
Input Power Cord is loose in connection.	Please re-connect the loose Input Power Cord properly back to its position.
Input detecting circuit is out of order.	Please check whether the U1(LM324) or D1(1N4148) Of MS-D9917-x are defective.
Over-voltage Trip-off circuit is out of order.	1.Refer to fig4.1. Please check those items of MS-D9917-x Boards are defective: 2. The transformer T3 is open. 3. C69 is 11-13V? 4. D34, and Relay K1

4.2. Fault LED Lights up and No Output

4.2.1. Troubleshooting

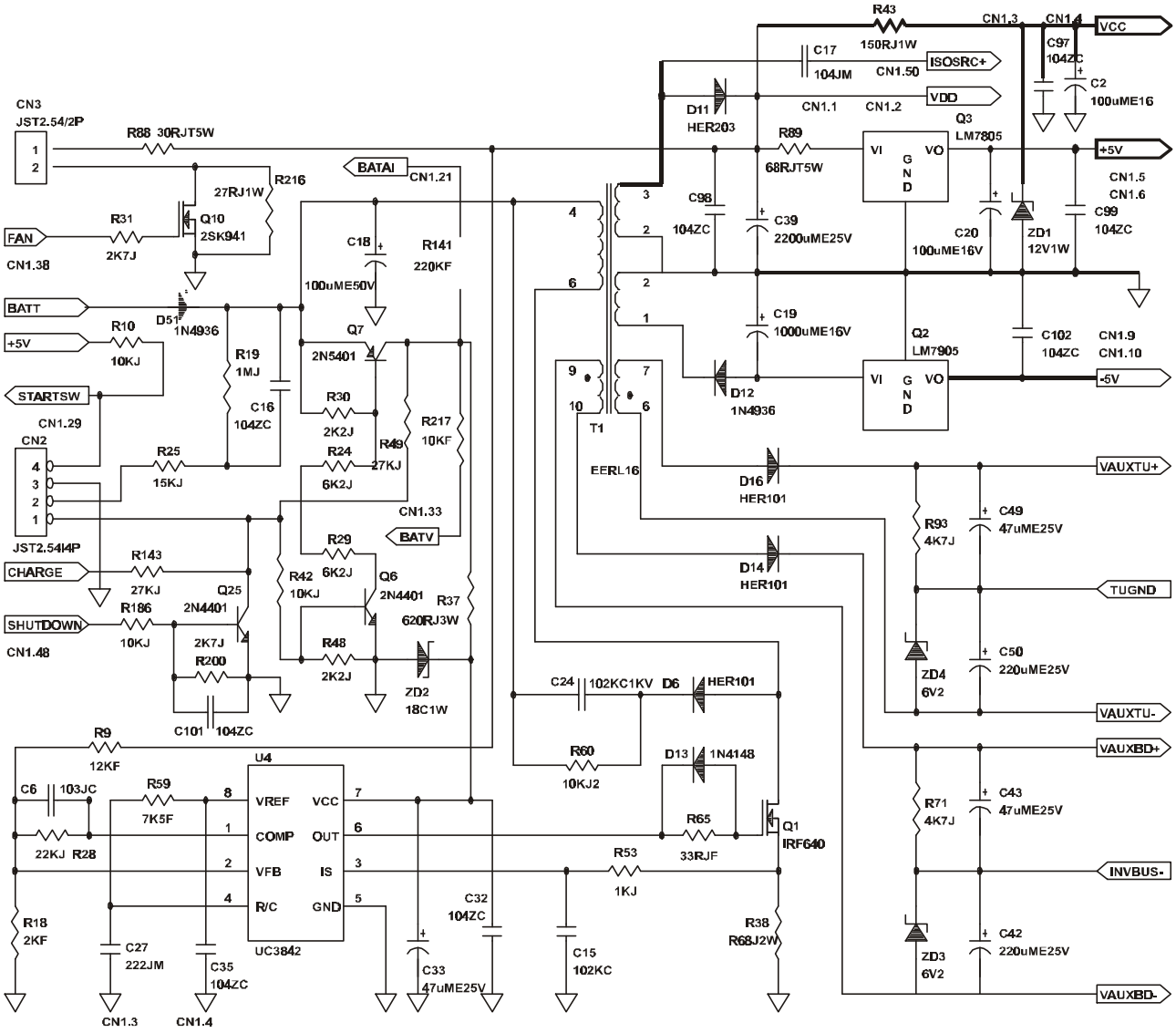


FIG. 4.2

Check Items	***Trouble-shooting***
Output Short Circuit	Check if the output end of the UPS is in short circuit.
Overload(>120%)	Reduce the output load. MS1K/MS1KR: 1000VA/700W
Battery voltage is abnormal	1.If the battery voltage is under 28.8V, replace the batteries。 2.Remove the battery, check the charge voltage. If the voltage is over 43V, the charger circuit is out of order. Refer to fig4.1, please check U14、U10、VR1 and other device nearby.
INVERTER Voltage ERROR	Refer to fig.4-4, Check U7、U8、Q13、Q14 。
The Fan on the rear panel is out of order	1. Check to see if the connection to the fan is Properly done.

	2. Connect 12Vdc t o the Fan(red line to positive) to check if the fan is normal. 3. Otherwise, please check the related circuit as fig 4-2.
Environmental Temperature is out of windows(Over 40 degree C)	Improve the ventilation and reduce the temperature of the environment.
BUS Voltage abnormal	The PFC conrtrol IC U2 or the Booster control IC U9 may be abnormal.
The feedback signal to CPU is abnormal.	1. Check if the connection between the control Board and the driver board is properly done. 2.Check if pin1 of U5(HA17393) of the driver board is sending out a square wave of Utility frequency.

4.2.2.Fault Status Analysis

When the Fault LED lights up, you may know which part of the UPS is out of order by Pushing the Test Switch in front.

Utility	***Inverter***	***Battery Low***	***Overload***	***Symptom***
0	0	0	1	Short Circuit
0	0	1	0	Inverter Over-current
0	0	1	1	Battery Voltage Abnormal
0	1	0	0	Inverter Voltage Abnormal
0	1	0	1	Heat Sink Overheat
0	1	1	0	DC Bus Fault

p.s. A code composed by Utility, Inverter, Battery Low and Overload LEDs may indicate the possible fault conditions by pushing the Test Switch button in front.

4.3. Input Fuse is burnt

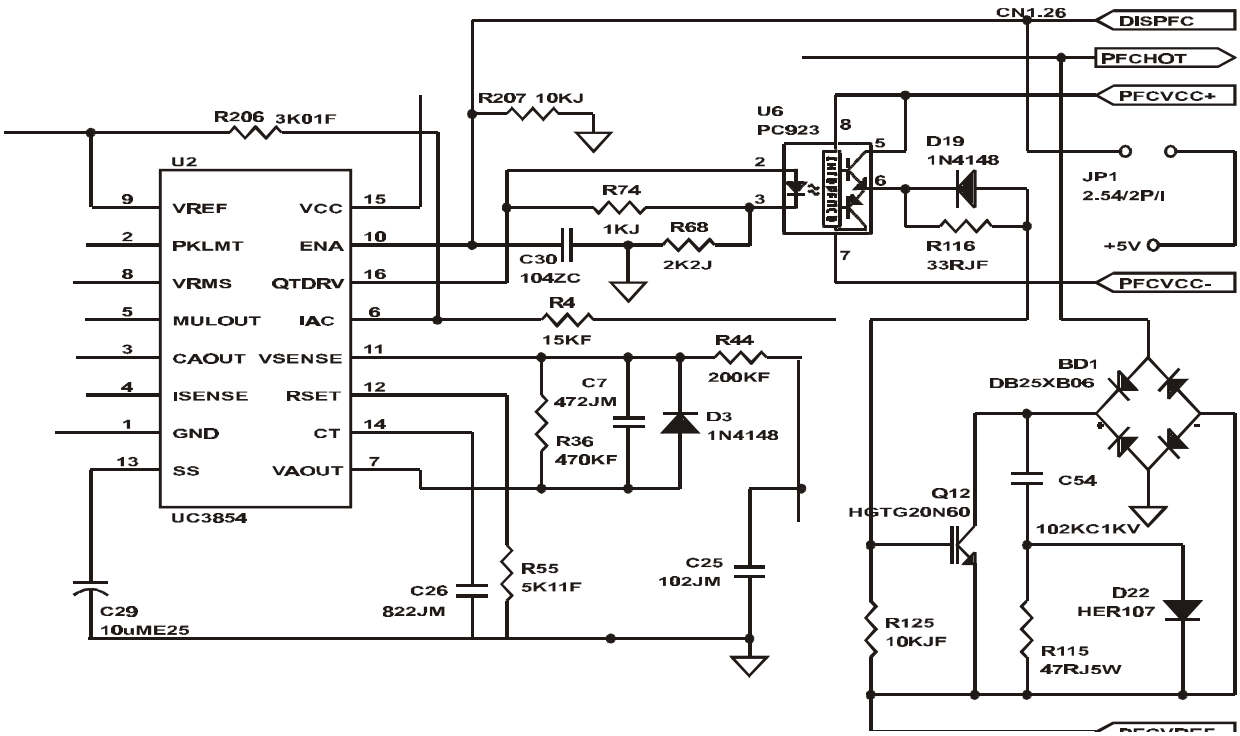


FIG. 4.3

Check Items	***Trouble-shooting***
The IGBT of Inverter Stage is out of order	1. Check the related circuit as shown in fig.4-4. Check Q14, Q13, D24, D25, R118 and R120 are defective. If Q14、Q13 is abnormal, U7,U8 need to be replaced, too. 2. Check Q12, U6、BD1 in PFC circuit (fig4-3). If Q12 is abnormal, replace both U6 and Q12. 3. Check D30-D33, Q15-Q20 and U9, refer to fig.4-5.
UPS Output Short Circuit or Overload	Remove the output load. If the UPS works Normally, it means the output load connected is in short circuit or overload.
PFC is abnormal	1. Check the related circuit as shown in fig.4-3. 2. Check if the PFC driving IGBT 20N60(Q12) and the photo coupler IC PC923(U6) are abnormal.

4.4. UPS Fails to Backup When Blackout

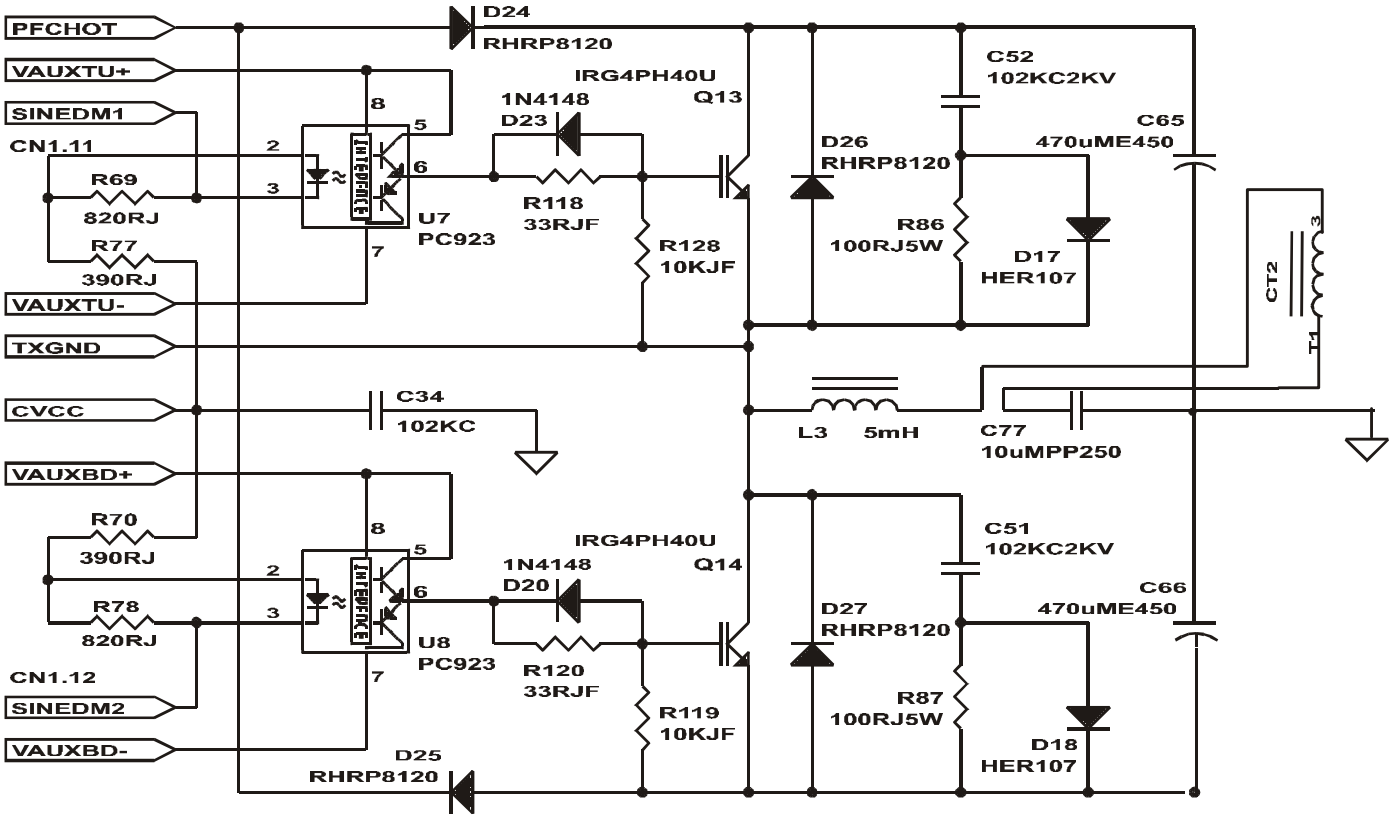


FIG. 4.4

Check Items	***Trouble-shooting***
Battery is weak and no battery charging urrent When it is in charging mode.	Remove the harness of the battery from the control board to measure the battery voltage. If the voltage drops dramatically, please use a switching power supply to charge the battery. The charging voltage can be set at 43.2Vdc,86.4Vdc, 115.2Vdc for MS1K(R), MS2K(R) and MS3K(R) respectively. The battery shall be charged up to 80% of its capacity.
Battery is defective	Replace the battery with same size.
Battery harness is loose in connection.	The current provided by the battery is approx. 20-30A when it is at full load. Please proceed to check any loose connection.
DC to DC converter is abnormal and/or the battery fuse is defective.	1. Check the related circuit shown in fig. 4-5. 2. Check if Q15-Q20 , D30-D33 of the driver board are defective. 3. Check if the U9 SG3525 is out of order. 4. Check if the Booster Transformer T2 is open. 5. After replace the defective devices. To make sure the other parts of the UPS is OK. Disconnect the logic board from driver board. Cut off the Utility. Provide 36Vdc to CN5(+) and CN4(-) by a DC Power Supply, connect CN2 to the main switch. Push on the main switch and to see if DC POWER of UPS, i.e. VDD(18-16V), VCC(12V) and +/-5V is normal.
The IC of DC Booster stage is out of order.	1. Check the related circuit is normal as shown in fig. 4-5. 2. Check if the U9(IC SG3525) is normal. Cut the Utility Source , remoe the battery and remove the control board, add a 36Vdc to CN5 and CN4 and 18Vdc To the pin 15 of U9 and short JP3 and check if the pin 16 of U9 is 5.1V and pulses can be found at Pin 11 and Pin 14 of U9. If not, please replace the U9. 3. The MosFet (Q15-Q20) and Diode(D30-D33) maybe abnormal, please check them.

4.5. No LEDs and No Output

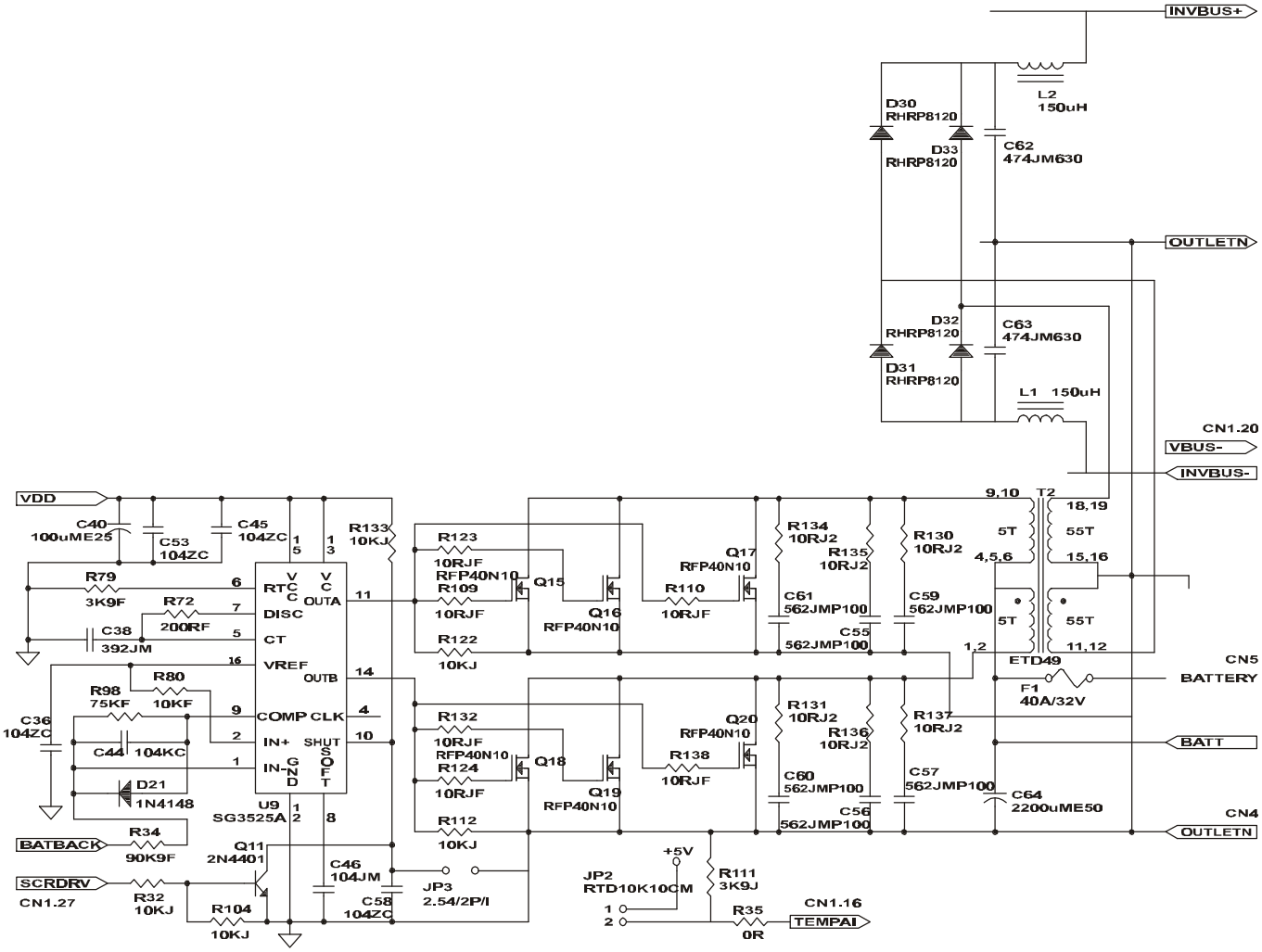


FIG. 4.5

Check Items	***Trouble-shooting***
Power Devices defective, AC or DC fuse is burn	Please see table 4.3 and 4.4 .
The working voltage of the control board is out of order.	1. Please check the circuit shown in fig.4-2. 2. Cut off the Utility. Remove the control board. Supply a 36Vdc to CN5 and CN4 by a DC Power supply, connect CN2 to the main switch. Push on the main switch and to see if DC POWER, i.e. VDD(17.5V), VCC(12V) and +/-5V is normal. 3. Check if Q1, Q6, Q7, Q25, D11, D12 and U4 Is normal. 4. Check if any abnormal output signal of the U9.
CPU is down.	If the DC POWER is normal, the CPU could be Down. Remove the battery harness from the UPS and re-connect it back to its position.

4.6. Main Switch Off, Remove Utility, the Fan is Still Working.

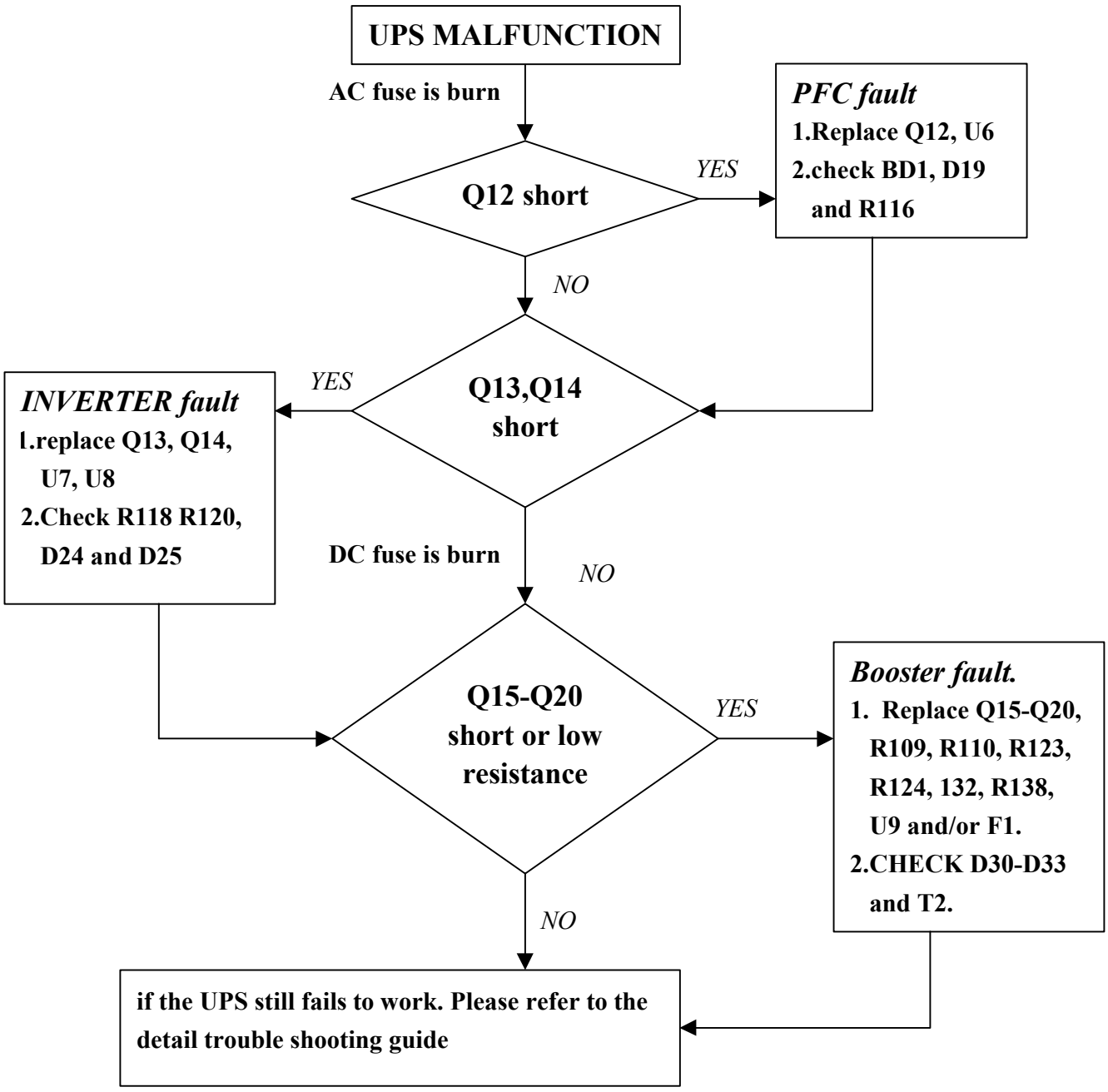
Check Items	***Trouble-shooting***
Self-Keeping Circuit is out of order	1. Please check the related circuit as shown in 4-2. 2. Cut off the Utility, turn off the front switch then remove and re-connect the harness of the battery to see whether the fan still remains spinning. If so, it means Q6, Q7 or Q25 could be defective.
CPU Shutdown function is out of order	Cut off the Utility, turn off the front switch then Remove of the battery, to see if the fan still remains spinning. If not, you may re-start up the UPS. However, you are recommended to replace the CPU.

NOTE A: ***After replace the defective devices, make sure other parts of UPS is Normal by following the steps below:***

1. ***Cut off the Utility. Remove the control board. Provide 36Vdc to CN5 and CN4 by a DC Power Supply, connect CN2 to the main switch. Push on the main switch to see if DC POWER of UPS, i.e. VDD(18-16V), VCC(12V) and +/-5V is normal. You may check VDD at CN1.1, VCC at CN1.3, +5V at CN1.5, Ground at CN1.7 or CN4, -5V at CNCN1.9.***
2. ***Turn off the power supply, connect the logic board with driver board and LED board.***
3. ***Turn on the DC Power Supply, and add the Utility. Push the Main Switch. Check the LED signals and Inverter output. Remove the Utility. Check again the LEDs and Inverter voltage.***
4. ***Connect the battery harness. Compose the other of UPS.***

NOTE B: ***Once the IGBT is defective, the photo coupler(PC923) related normally need to be replaced, too.***

4.7 Quick trouble shooting



Chapter Five: Trouble Shooting Guide For MS2K

5.1. Utility is Normal, but UPS on Battery Mode

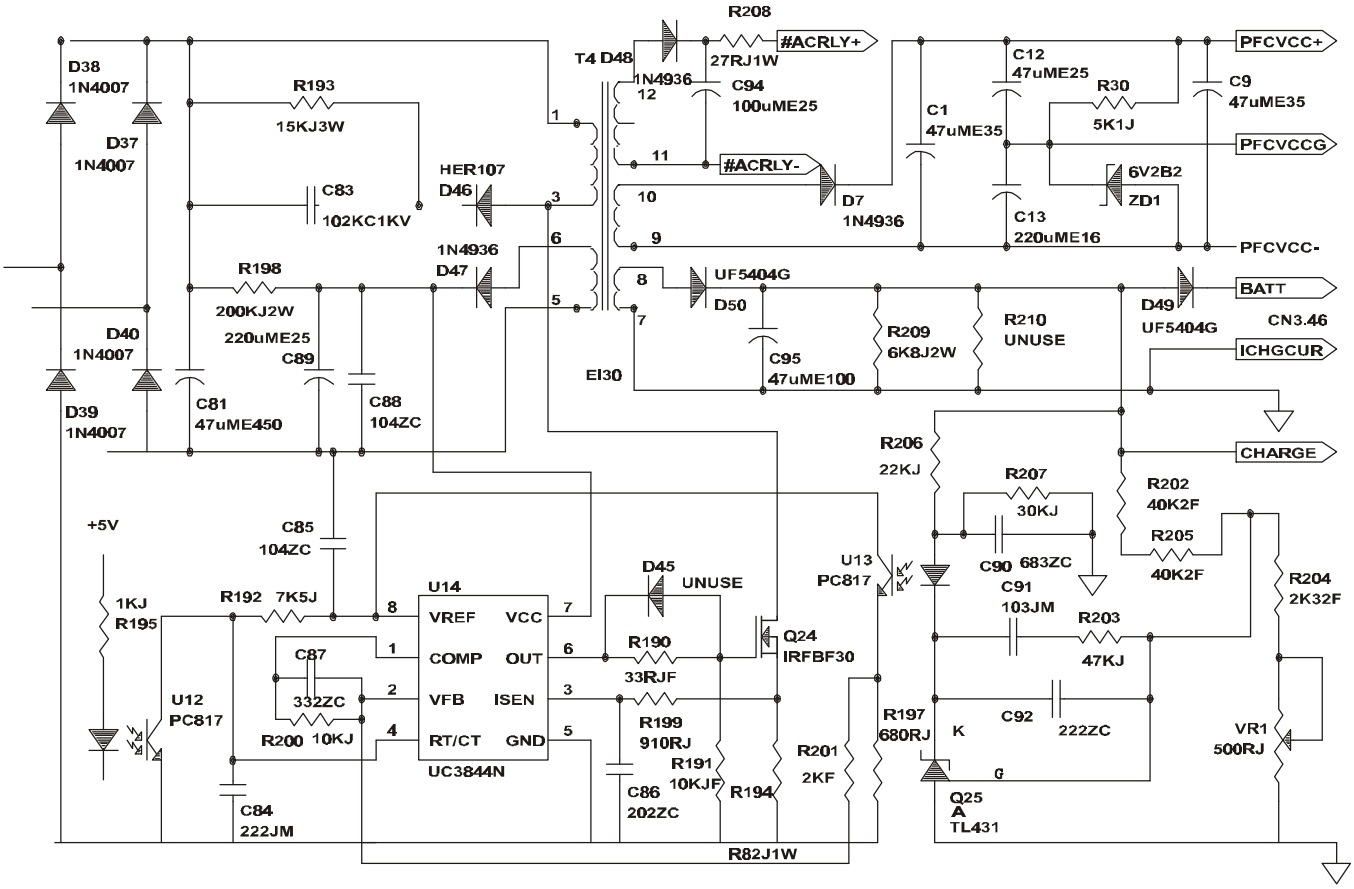


FIG. 5.1

Check Items	***Trouble-shooting***
Utility Voltage is out of windows(<80Vac or >140Vac for 120Vac system or <160Vac or >280Vac for 230Vac system)	Your Utility quality is too bad. You are recommended to install an AVR in front of the UPS.
Input AC fuse is broken.	Replace a new fuse with same rating one.
Input Power Cord is loose in connection.	Please re-connect the loose Input Power Cord properly back to its position.
Input detecting circuit is out of order.	Please check whether the U5(LM324) or D10(1N4148) Of MS-D9910-x are defective.
Over-voltage Trip-off circuit is out of order.	1. Refer to fig5.1. Please check those items of MS-D9910-x Boards are defective: 2. The transformer T4 is open. 3. . C94 is 11-13V? 4. D48, and Relay K1

5.2 Fault LED Lights up and No Output

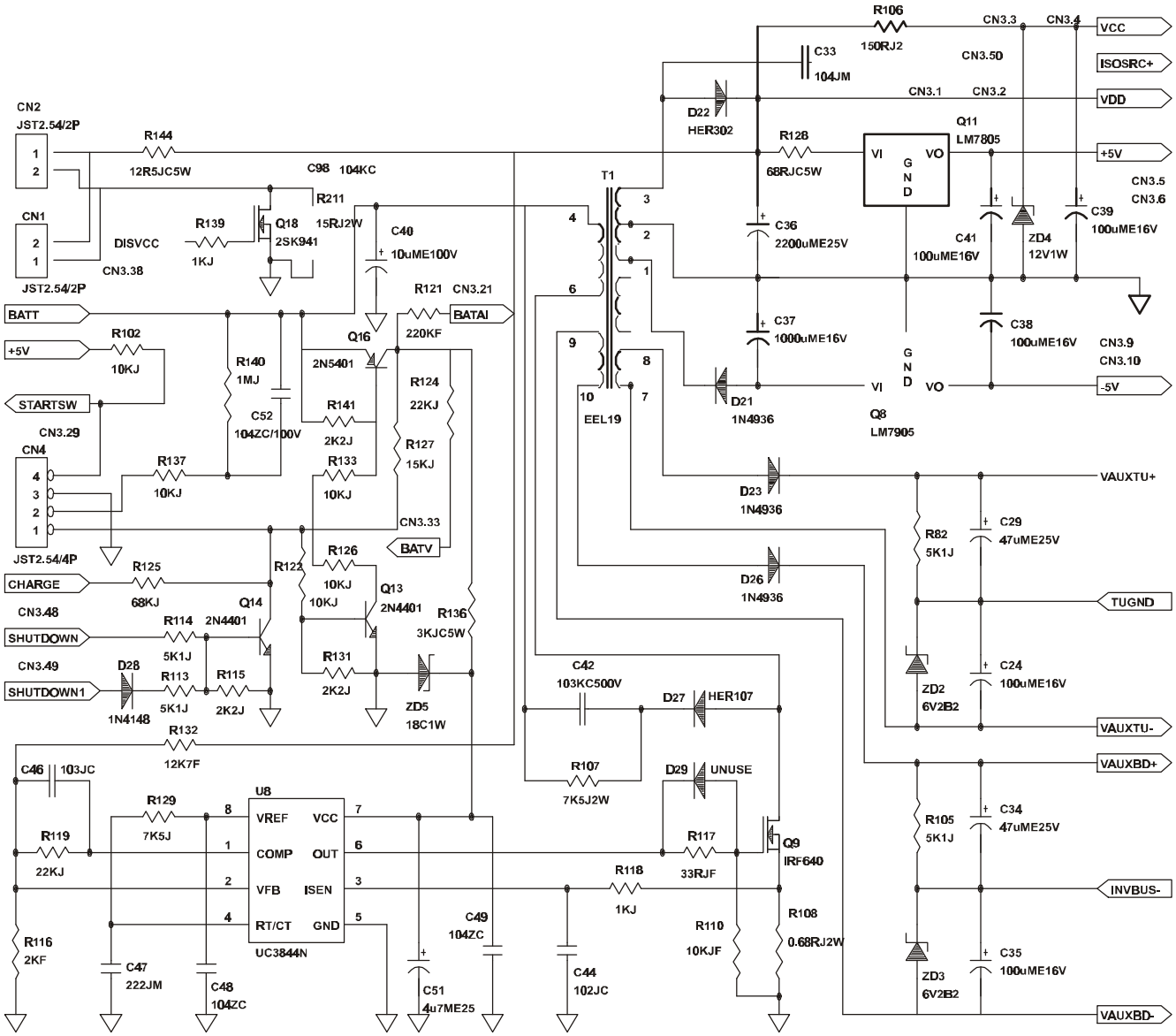


FIG. 5.2

5.2.1. Troubleshooting

Check Items	***Trouble-shooting***
Output Short Circuit	Check if the output end of the UPS is in short circuit.
Overload(>120%)	Reduce the output load to 2000VA/1400W
Battery voltage is abnormal	1. If the battery voltage is under 59V, replace the batteries。 2. Remove the battery, and check the charge voltage. if the voltage is over 86V, the charger circuit is out of order. Refer to fig5.1, please check U14、U13、VR1 and other device nearby.
INVERTER Voltage ERROR	Refer to fig.5-4, Check U6、U7、Q6、Q7 。
The Fan on the rear panel is out of order	1.Check to see if the connection to the fan is Properly done. 2.Connect 12Vdc t o the Fan(red line to positive) to check if the fan is normal. 3.Otherwise, please check the related circuit as fig 5-2.
Environmental Temperature is out of windows(Over 40 degree C)	Improve the ventilation and reduce the temperature of the environment.
BUS Voltage abnormal	The PFC control IC U2 or the Booster control IC U9 may be abnormal.
The feedback signal to CPU is abnormal.	1.Check if the connection between the control Board and the driver board is properly done. 2.Check if pin1 of U1(HA17393) of the driver board is sending out a square wave of Utility frequency.

5.2.2.Fault Status Analysis

When the Fault LED lights up, you may know which part of the UPS is out of order by Pushing the Test Switch in front.

Utility	***Inverter***	***Battery Low***	***Overload***	***Symptom***
0	0	0	1	Short Circuit
0	0	1	0	Inverter Over-current
0	0	1	1	Battery Voltage Abnormal
0	1	0	0	Inverter Voltage Abnormal
0	1	0	1	Heatsink Overheat
0	1	1	0	DC Bus Fault

p.s. A code composed by Utility, Inverter, Battery Low and Overload LEDs may indicate the possible fault conditions by pushing the Test Switch button in front.

5.3 Input Fuse is burnt

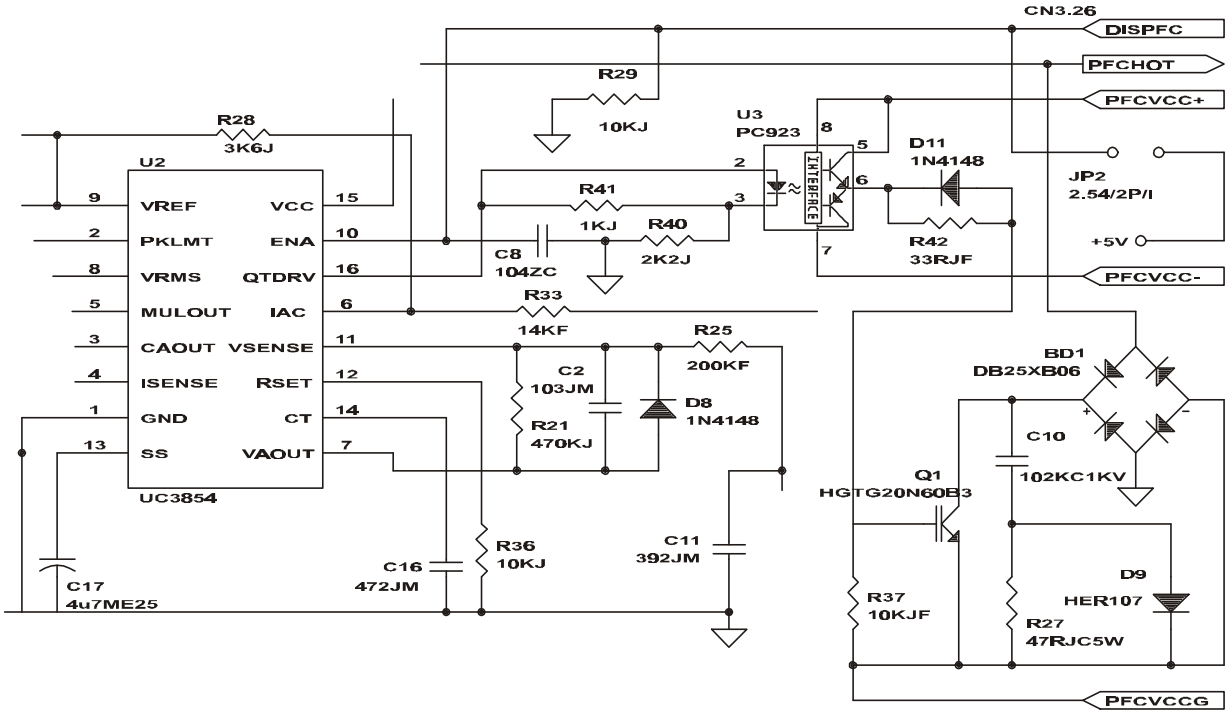


FIG. 5.3

Check Items	***Trouble-shooting***
The IGBT of Inverter Stage is out of order	1.Check the related circuit as shown in fig.5-4. Check Q6, Q7, D12, D13, R83 and R104 are defective. If Q6&Q7 are abnormal, the U6 & U7 need to be replaced, too. 2.Check Q1, U3、BD1 in PFC circuit (fig5-3).If Q1 is abnormal, replace both U6 and Q1. 3. Check D31-D34, Q10, Q12, Q15, Q17, Q19, Q21 and U9, Refer to fig.5-5.
UPS Output Short Circuit or Overload	Remove the output load. If the UPS works Normally, it means the output load connected is in short circuit or overload.
PFC is abnormal	1.Check the related circuit as shown in fig.5-3. 2.Check if the PFC driving IGBT 20N60(Q1) and the photo coupler IC PC923(U3) are abnormal.

5.4 UPS Fails to Backup When Blackout

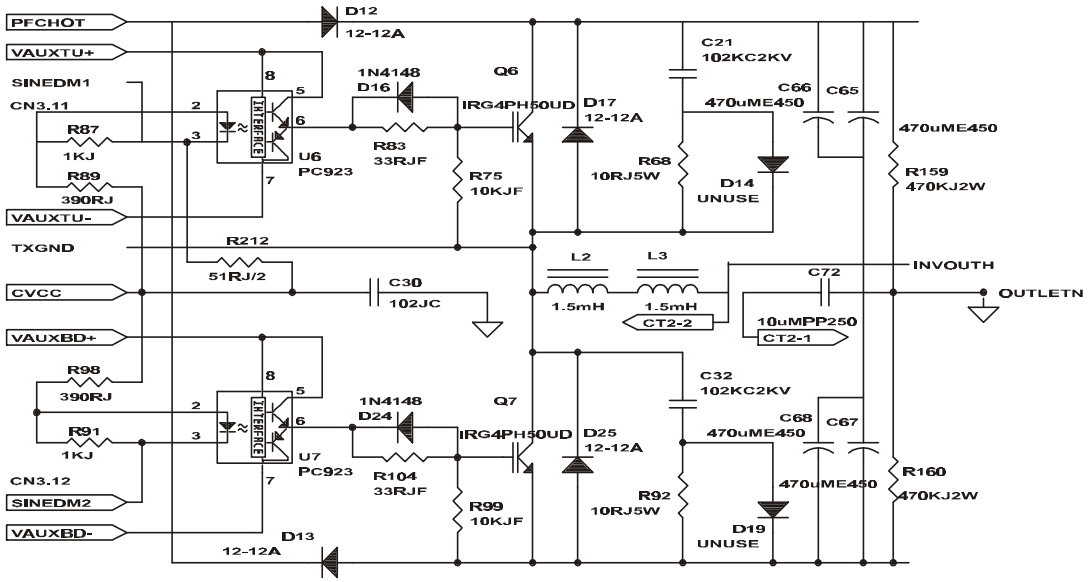


FIG. 5.4

Check Items	***Trouble-shooting***
Battery is weak and no battery charging current When it is in charging mode.	Remove the harness of the battery from the control board to measure the battery voltage. If the voltage drops dramatically, please use a switching power supply to charge the battery. The charging voltage can be set at 86.4Vdc. The battery shall be charged up to 80% of its capacity.
Battery is defective	Replace the battery with same size.
Battery harness is loose in connection.	The current provided by the battery is approx. 20-30A when it is at full load. Please proceed to check any loose connection.
The IC of DC Booster stage is out of order.	1.Check the related circuit is normal as shown in fig. 5-5. 2.Check if the U9(IC SG3525) is normal. Cut the Utility Source , remove the battery and remove the control board, add a 72Vdc to CN10(+) and CN9(-) and 18Vdc to the pin 15 of U9 and short JP3 and check if the pin 16 of U9 is 5.1V and pulses can be found at Pin 11 and Pin 14 of U9. If not, please replace U9. 3. The MosFETs (Q10, Q12, Q15, Q17, Q19, Q21) and Diode(D31-D34) maybe abnormal, please check them.
DC to DC converter is abnormal and/or the battery fuse is defective.	1.Check the related circuit shown in fig. 5-5. 2.Check if (Q10, Q12, Q15, Q17, Q19, Q21) and Diode(D31-D34) of the driver board are defective. 3.Check if the U9 SG3525 is out of order. 4.Check if the Booster Transformer T2、T3 is open. 5.After replace the defective devices. To make sure the other parts of the UPS is OK. Disconnect the logic board from driver board. Cut off the Utility. Provide 72Vdc to CN10(+) and CN9(-) by a DC Power Supply, connect CN4 to the main switch. Push on the main switch and to see if DC POWER of UPS, i.e. VDD(18-16V), VCC(12V) and +/-5V is normal.

5.5 No LEDs and No Output

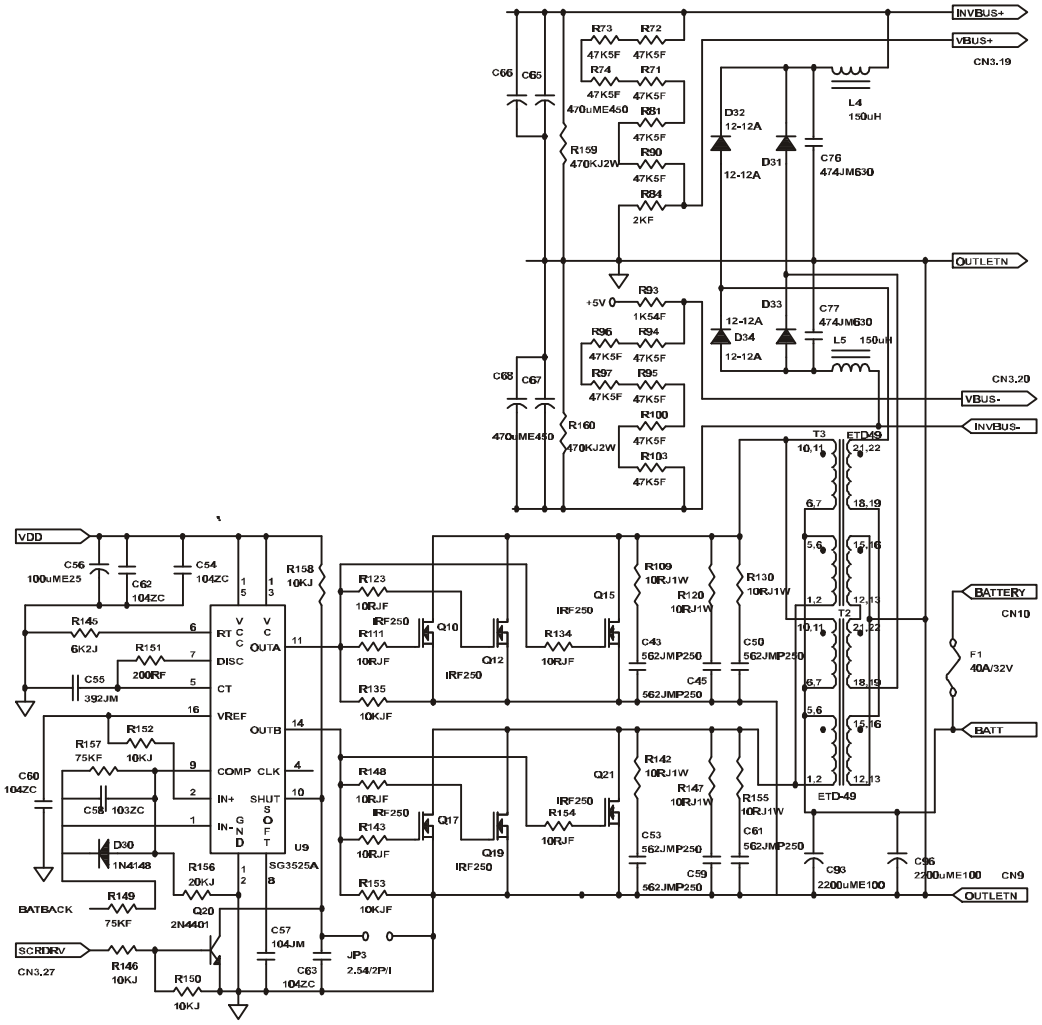


FIG. 5.5

Check Items	***Trouble-shooting***
Power Devices defective, AC or DC fuse is burn	Please see table 5.3 and 5.4 .
The working voltage of the control board is out of order.	1.Please check the circuit shown in fig.5-2. 2.Cut off the Utility. Remove the control board. Supply a 72Vdc to CN10(+) and CN9(-) by a DC Power supply, connect CN4 to the main switch. Push on the main switch and to see if DC POWER, i.e. VDD(17.5V), VCC(12V) and +/- 5V is normal. 3.Check if Q9, Q16, Q13, Q14, D22, D21 and U8 Is normal. 4. Check if any abnormal output signal of the U9.
CPU is down.	If the DC POWER is normal, the CPU could be Down. Remove the battery harness from the UPS and re-connect it back to its position.

5.6 Main Switch Off, Remove Utility, the Fan is Still Working.

Check Items	***Trouble-shooting***
Self-Keeping Circuit is out of order	1.Please check the related circuit as shown in 5-2. 2.Cut off the Utility, turn off the front switch then remove and re-connect the harness of the battery to see whether the fan still remains spinning. If so, It means Q13, Q14 or Q16 could be defective.
CPU Shutdown function is out of order	Cut off the Utility, turn off the front switch then Remove of the battery, to see if the fan still remains Spinning. If not, you may re-start up the UPS. However, you are recommended to replace the CPU.

NOTE A : After replace the defective devices, to make sure other parts of UPS is Normal, please follow the steps below:

1.Cut off the Utility. Remove the control board. Provide 72Vdc to CN10(+) and CN4(-) by a DC Power Supply, connect CN4 to the main switch then push on the main switch to see if DC POWER of UPS, i.e. VDD(18-16V), VCC(12V) and +/-5V is normal. You may check VDD at CN3.1, VCC at CN3.3, +5V at CN3.5, Ground at CN3.7 or CN10, -5V at CNCN3.9.

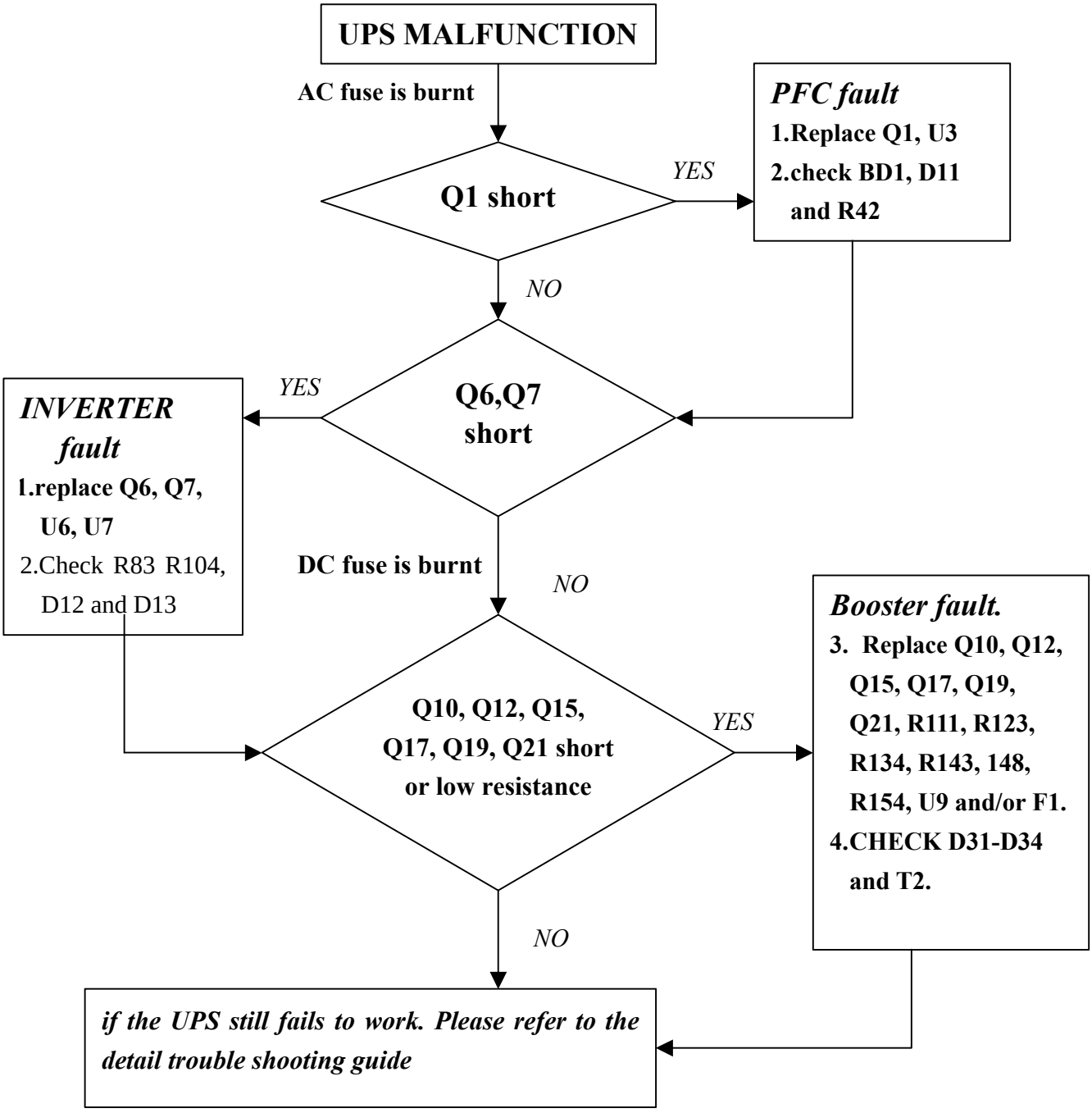
2.Turn off the power supply, connect the logic board with driver board and LED board.

3. Turn on the DC Power Supply, and add the Utility. Push the Main Switch. Check the LED signals and Inverter output. Remove the Utility. Check again the LEDs and Inverter voltage.

4.Connect the battery harness. Compose the other of UPS.

NOTE B: Once the IGBT is defective, the photo coupler(PC923) related normally need to be replaced, too.

5.7 Quick trouble shooting



Chapter Six: Trouble Shooting Guide For MS3K

6.1. Utility is Normal, but UPS on Battery Mode

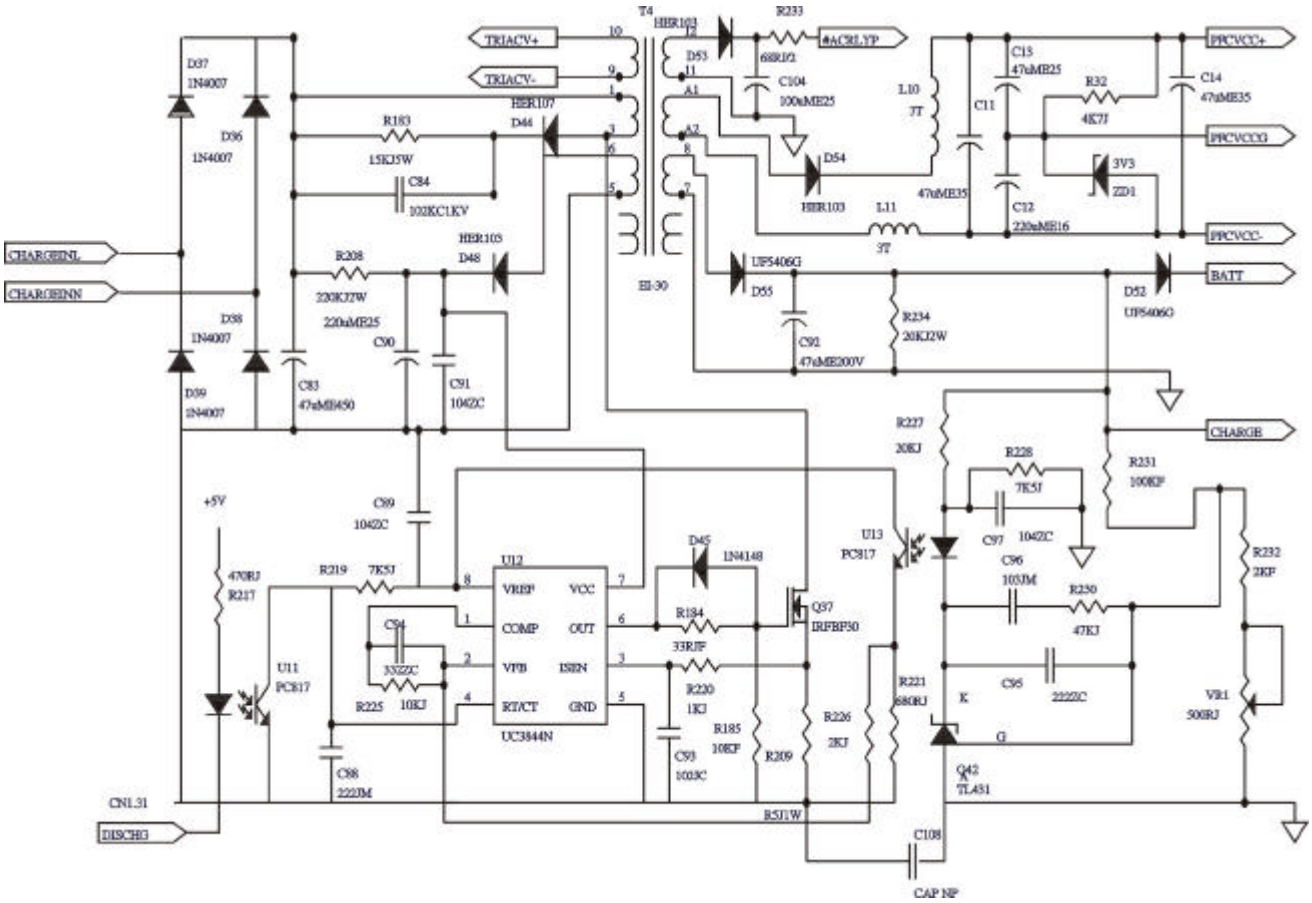


FIG. 6.1

Check Items	***Trouble-shooting***
Utility Voltage is out of windows(<80Vac or >140Vac for 120Vac system or <160Vac or >280Vac for 230Vac system)	Your Utility quality is too bad. You are recommended to install an AVR in front of the UPS.
Input AC fuse is broken.	Replace a new fuse with same rating one.
Input Power Cord is loose in connection.	Please re-connect the loose Input Power Cord properly back to its position.
Input detecting circuit is out of order.	Please check whether the U5(LM324) or D13(1N4148) Of MSCD0xx are defective.
Over-voltage Trip-off circuit is out of order.	1.Refer to fig 6.1. Please check those items of MSCD0xx Board are defective: 2.The transformer T4 is open. 3.C104 is 11-15V? 4.Check D53, and Relay K1

6.2 Fault LED Lights up and No Output

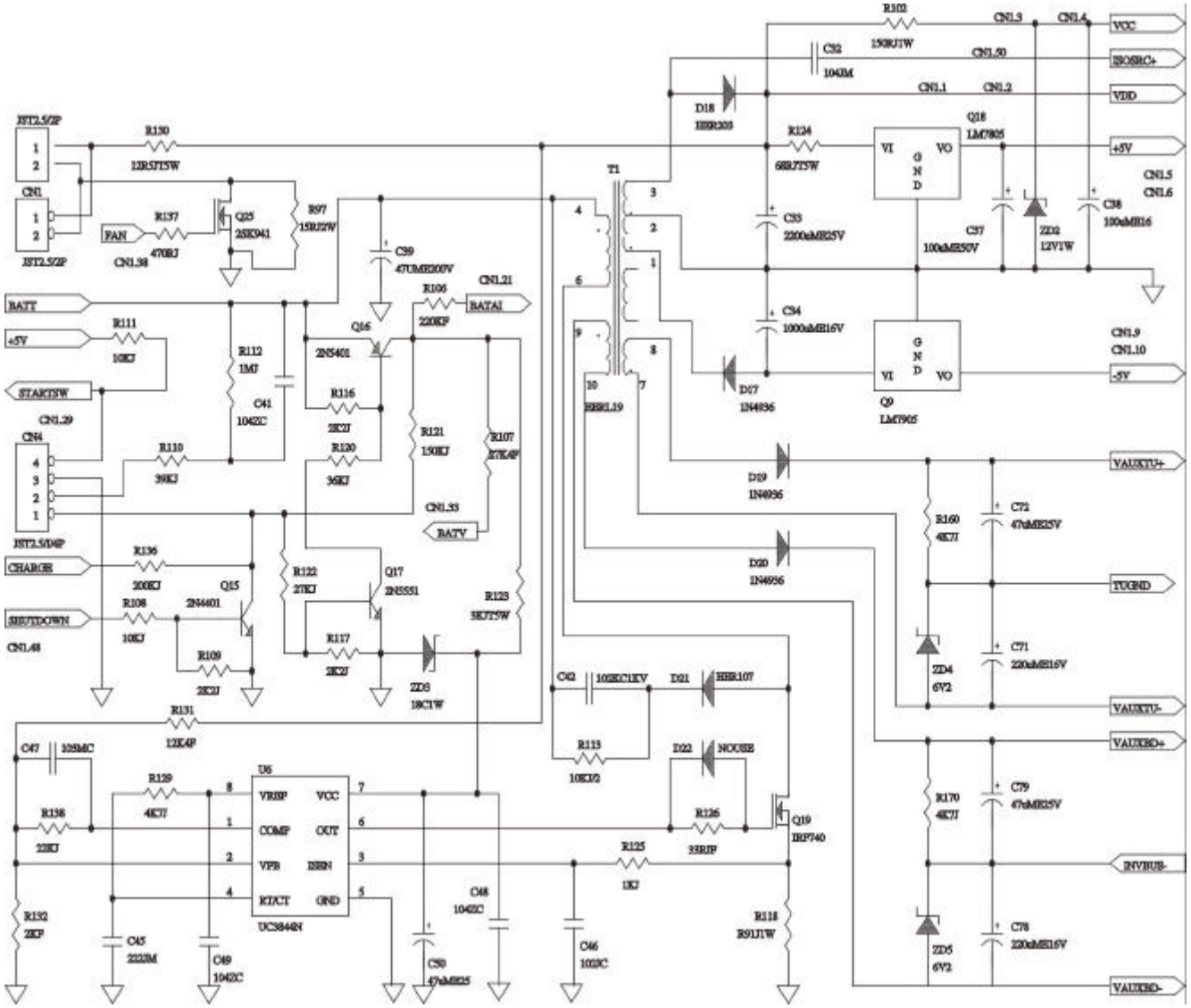


FIG. 6.2

6.2.1. Troubleshooting

Check Items	***Trouble-shooting***
Output Short Circuit	Check if the output end of the UPS is in short circuit.
Overload(>120%)	Reduce the output load to 3000VA/2100W
Battery voltage is abnormal	1. If the battery voltage is under 78V, replace the batteries。 2. Remove the battery, and check the charge voltage. if the voltage is over 115V, the charger circuit is out of order. Refer to fig6.1, please check U12、U13、VR1 and other device nearby.
INVERTER Voltage ERROR	Refer to fig.6-4, Check U8, U9, Q29, Q30, Q31, Q32。
The Fan on the rear panel is out of order	1.Check to see if the connection to the fan is Properly done. 2.Connect 12Vdc t o the Fan(red line to positive) to check if the fan is normal. 3.Otherwise, please check the related circuit as fig 6-2.
Environmental Temperature is out of windows(Over 40 degree C)	Improve the ventilation and reduce the temperature of the environment.
BUS Voltage abnormal	The PFC control IC U2 or the Booster control IC U7 may be abnormal.
The feedback signal to CPU is abnormal.	1.Check if the connection between the control Board and the driver board is properly done. 2.Check if pin1 of U1(HA17393) of the driver board is sending out a square wave of Utility frequency.

6.2.2.Fault Status Analysis

When the Fault LED lights up, you may know which part of the UPS is out of order by Pushing the Test Switch in front.

Utility	***Inverter***	***Battery Low***	***Overload***	***Symptom***
0	0	0	1	Short Circuit
0	0	1	0	Inverter Over-current
0	0	1	1	Battery Voltage Abnormal
0	1	0	0	Inverter Voltage Abnormal
0	1	0	1	Heatsink Overheat
0	1	1	0	DC Bus Fault

p.s. A code composed by Utility, Inverter, Battery Low and Overload LEDs may indicate the possible fault conditions by pushing the Test Switch button in front.

6.3 Input Fuse is burnt

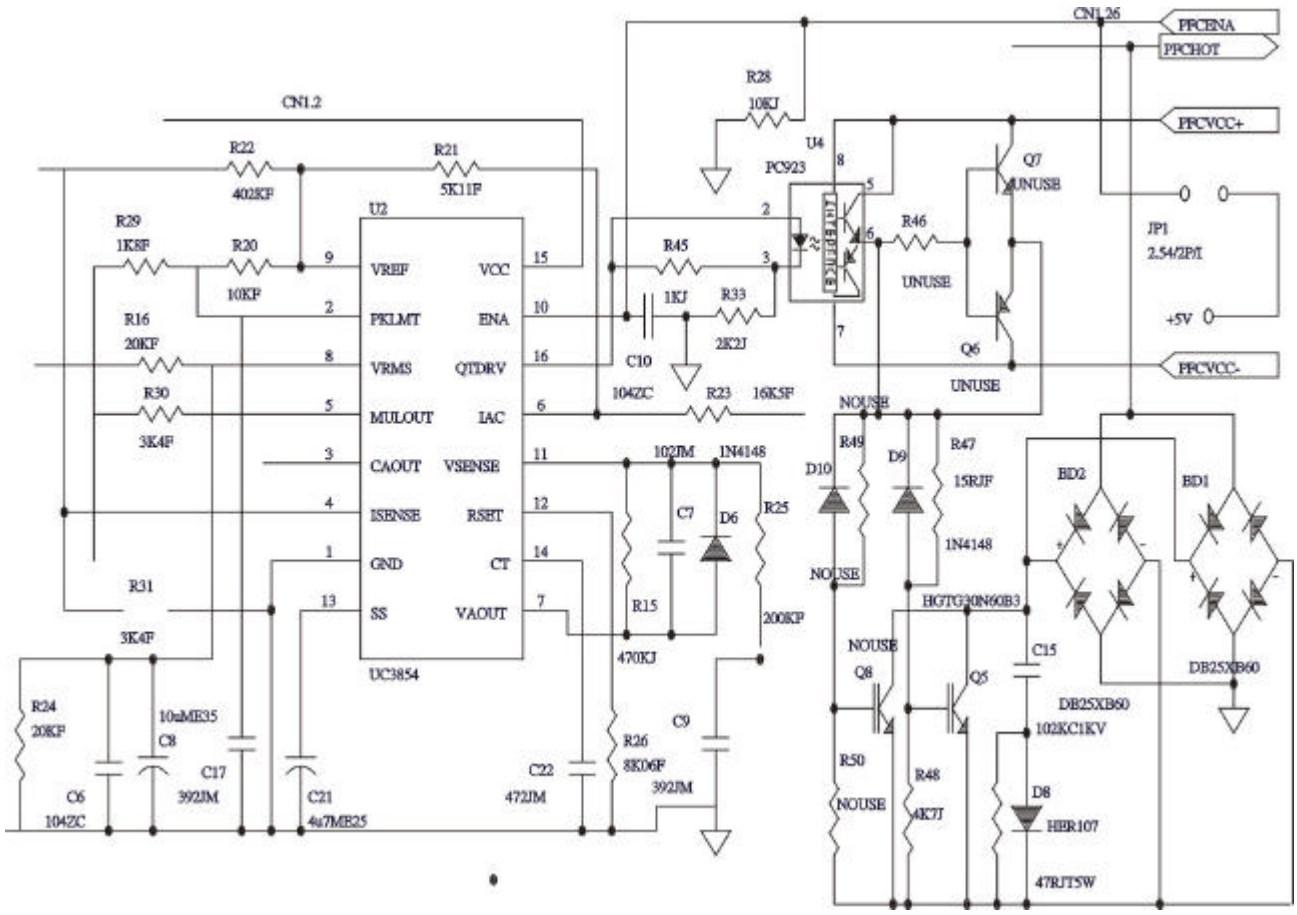


FIG. 6.3

Check Items	***Trouble-shooting***
The IGBT of Inverter Stage is out of order	1. Check the related circuit as shown in fig.6-4. Check Q29-Q32, D15, D16, R159, R163, R169 and R172 are defective. If Q29-Q32 are abnormal, the U8 & U9 need to be replaced, too. 2.Check Q5, U4、BD1, BD2 in PFC circuit (fig6-3).If Q5 is abnormal, replace both U4 and Q5. 3. Check D32-D35, Q12-Q14, Q24, Q27, Q28 and U7, Refer to fig.6-5.
UPS Output Short Circuit or Overload	Remove the output load. If the UPS works Normally, it means the output load connected is in short circuit or overload.
PFC is abnormal	1.Check the related circuit as shown in fig.5-3. 2.Check if the PFC driving IGBT 30N60(Q5) and the photo coupler IC PC923(U4) are abnormal.

6.4 UPS Fails to Backup When Blackout

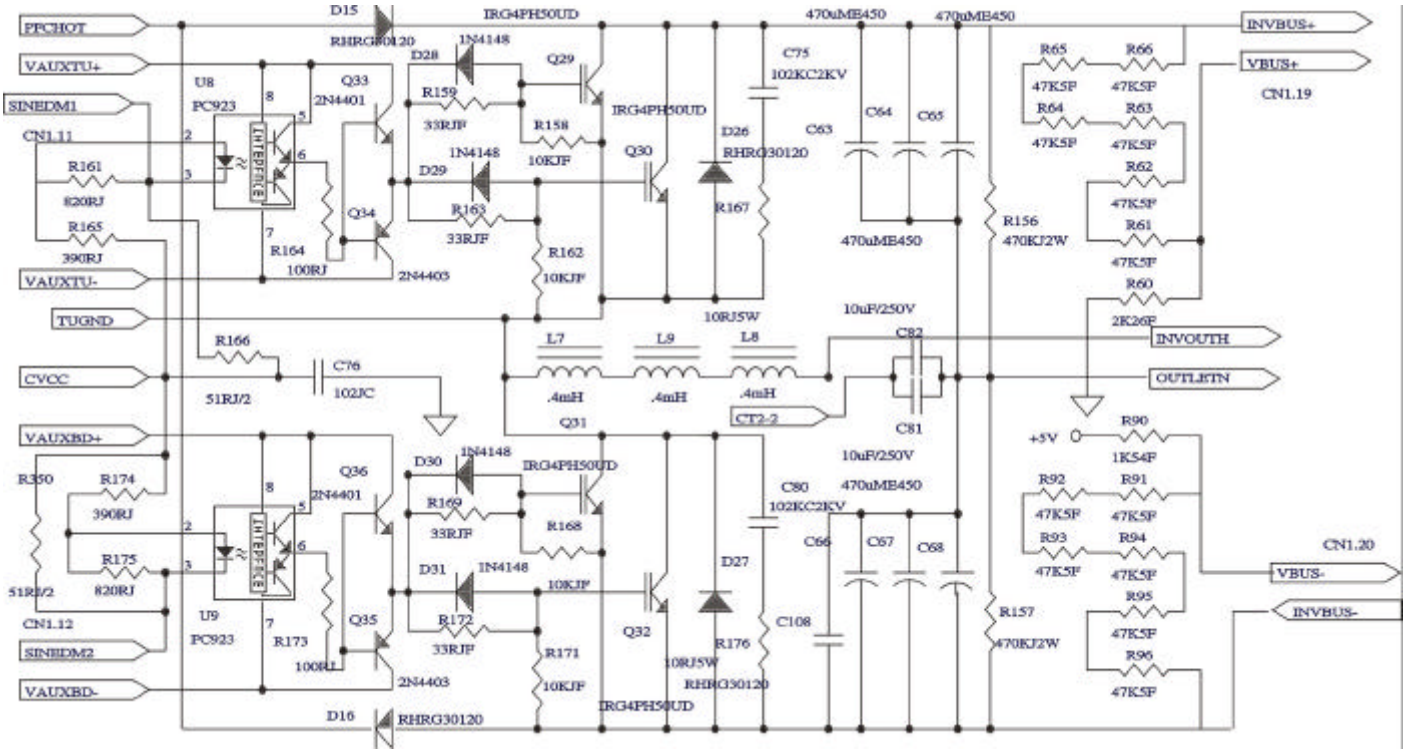


FIG. 6.4

Check Items	***Trouble-shooting***
Battery is weak and no battery charging current When it is in charging mode.	Remove the harness of the battery from the control board to measure the battery voltage. If the voltage drops dramatically, please use a switching power supply to charge the battery. The charging voltage can be set at 115.2Vdc. The battery shall be charged up to 80% of its capacity.
Battery is defective	Replace the battery with same size.
Battery harness is loose in connection.	The current provided by the battery is approx. 20-30A when it is at full load. Please proceed to check any loose connection.
The IC of DC Booster stage is out of order.	1.Check the related circuit is normal as shown in fig. 6-5. 2.Check if the U7(IC SG3525) is normal. Cut the Utility Source , remove the battery and remove the control board, add a 96Vdc to CN5(+) and CN6(-) and 18Vdc to the pin 15 of U7 and short JP2 and check if the pin 16 of U7 is 5.1V and pulses can be found at Pin 11 and Pin 14 of U7. If not, please replace U7. 2.The MosFETs (Q12, Q13, Q14, Q24, Q27, Q28) and Diode(D32-D35) maybe abnormal, please check them.
DC to DC converter is abnormal and/or the battery fuse is defective.	1.Check the related circuit shown in fig. 6-5. 2.Check if (Q12, Q13, Q14, Q24, Q27, Q28) and Diode(D32-D35) of the driver board are defective.

	3.Check if the U7 SG3525 is out of order. 4.Check if the Booster Transformer T2、T3 is open. 5.After replace the defective devices. To make sure the other parts of the UPS is OK. Disconnect the logic board from driver board. Cut off the Utility. Provide 96Vdc to CN5(+) and CN6(-) by a DC Power Supply, connect CN4 to the main switch. Push on the main switch and to see if DC POWER of UPS, i.e. VDD(18-16V), VCC(12V) and +/-5V is normal.

6.5 No LEDs and No Output

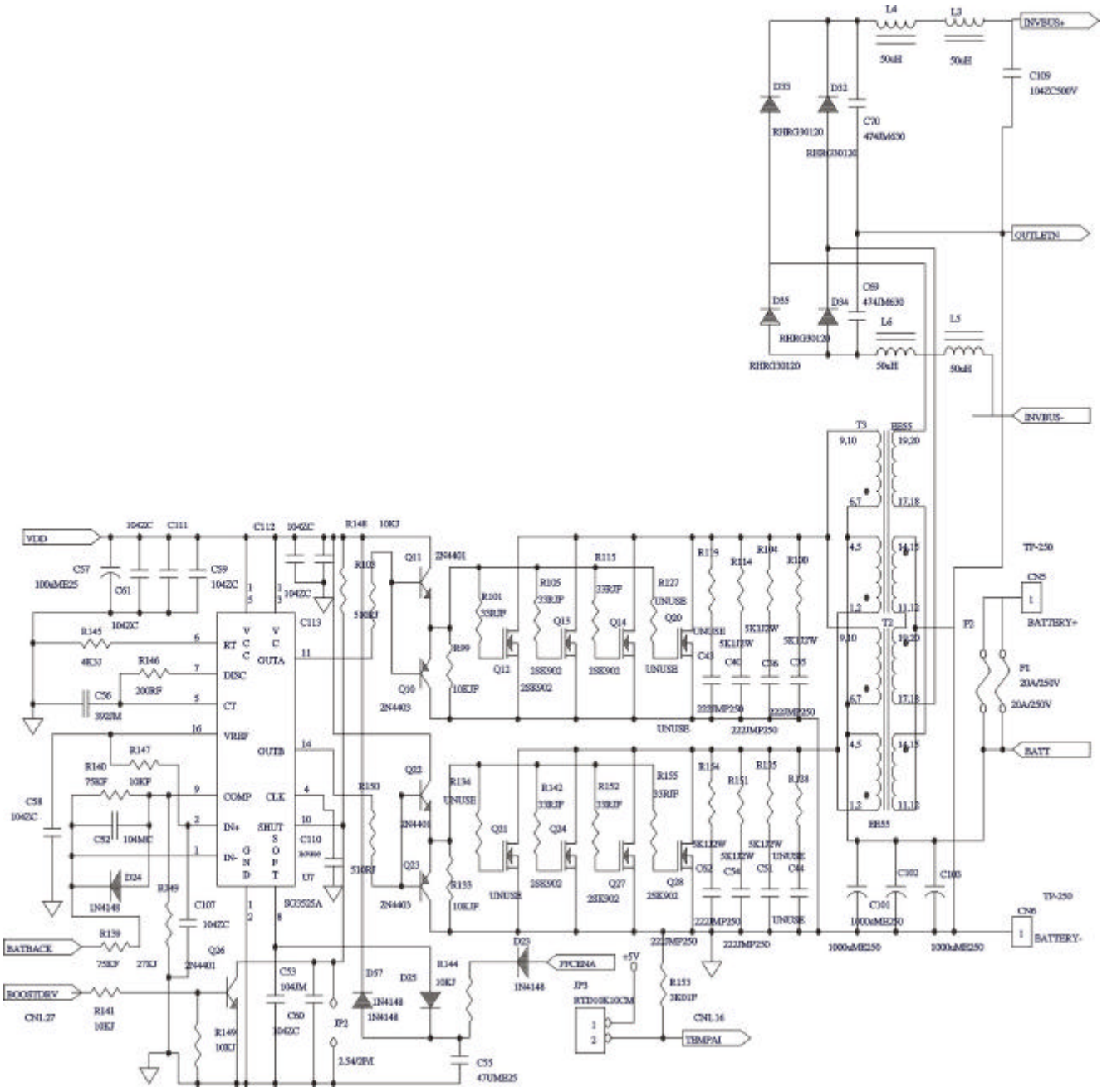


FIG. 6.5

Check Items	*Trouble-shooting*
Power Devices defective, AC or DC fuse is burn	Please see table 5.3 and 5.4 .
The working voltage of the control board is out of order.	1.Please check the circuit shown in fig.6-2. 2.Cut off the Utility. Remove the control board. Supply a 96Vdc to CN5(+) and CN6(-) by a DC Power supply, connect CN4 to the main switch. Push on the main switch and to see if DC POWER, i.e. VDD(17.5V), VCC(12V) and +/-5V is normal. 3.Check if Q15, Q16, Q17, Q19, D17, D18 and U6 Is normal. 4. Check if any abnormal output signal of the U7.
CPU is down.	If the DC POWER is normal, the CPU could be Down. Remove the battery harness from the UPS and re-connect it back to its position.

6.6 Main Switch Off, Remove Utility, the Fan is Still Working.

Check Items	*Trouble-shooting*
Self-Keeping Circuit is out of order	1.Please check the related circuit as shown in 6-2. 2.Cut off the Utility, turn off the front switch then remove and re-connect the harness of the battery to see whether the fan still remains spinning. If so, It means Q15, Q16 or Q17 could be defective.
CPU Shutdown function is out of order	Cut off the Utility, turn off the front switch then Remove of the battery, to see if the fan still remains Spinning. If not, you may re-start up the UPS. However, you are recommended to replace the CPU.

NOTE A : ***After replace the defective devices, to make sure other parts of UPS is Normal, please follow the steps below:***

3.Cut off the Utility. Remove the control board. Provide 96Vdc to CN5(+) and CN6(-) by a DC Power Supply, connect CN4 to the main switch then push on the main switch to see if DC POWER of UPS, i.e. VDD(18-16V), VCC(12V) and +/-5V is normal. You may check VDD at CN3.1, VCC at CN3.3, +5V at CN3.5, Ground at CN3.7 or CN10, -5V at CNCN3.9.

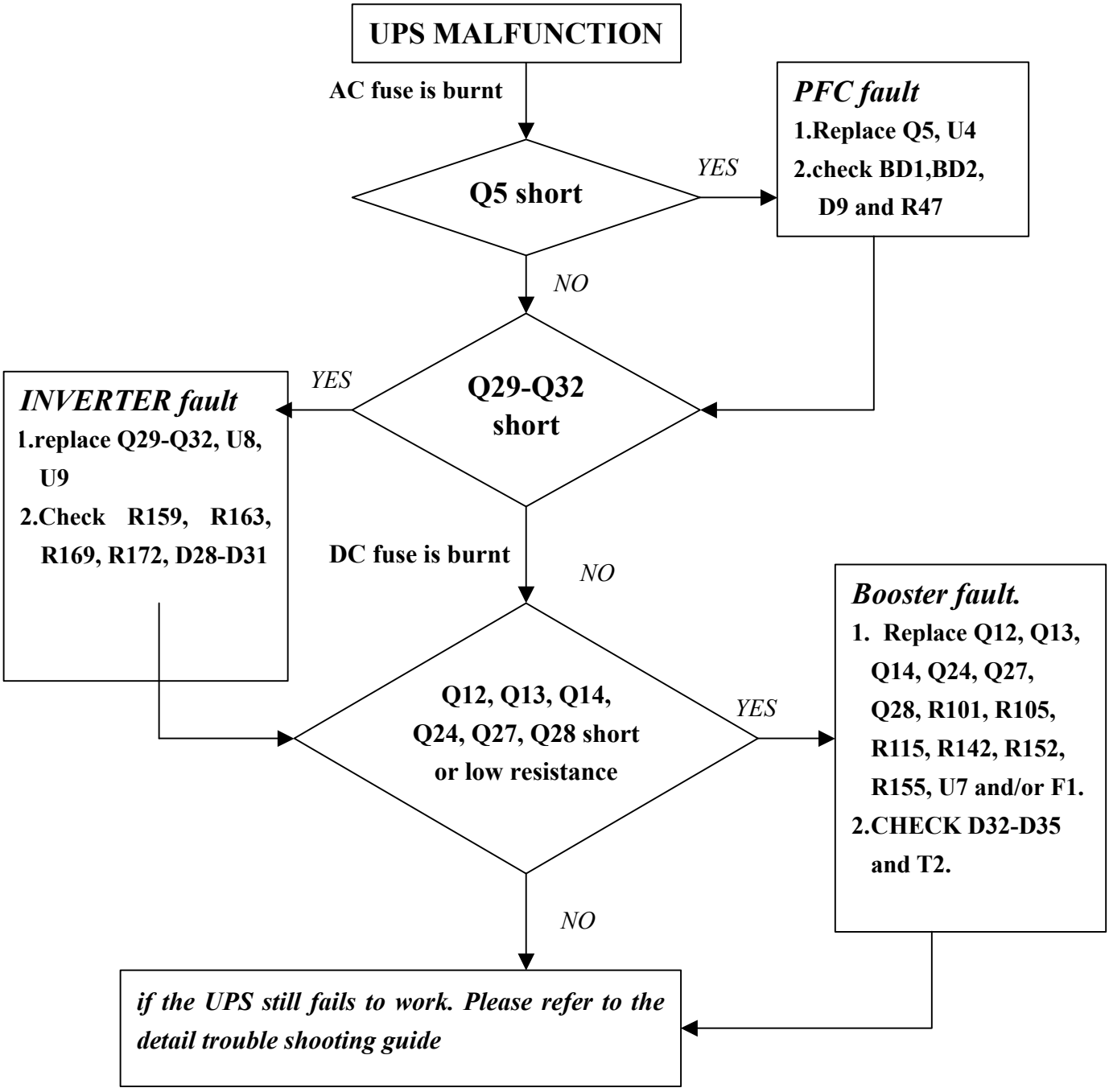
2.Turn off the power supply, connect the logic board with driver board and LED board.

3. Turn on the DC Power Supply, and add the Utility. Push the Main Switch. Check the LED signals and Inverter output. Remove the Utility. Check again the LEDs and Inverter voltage.

4.Connect the battery harness. Compose the other of UPS.

NOTE B: ***Once the IGBT is defective, the photo coupler(PC923) related normally need to be replaced, too.***

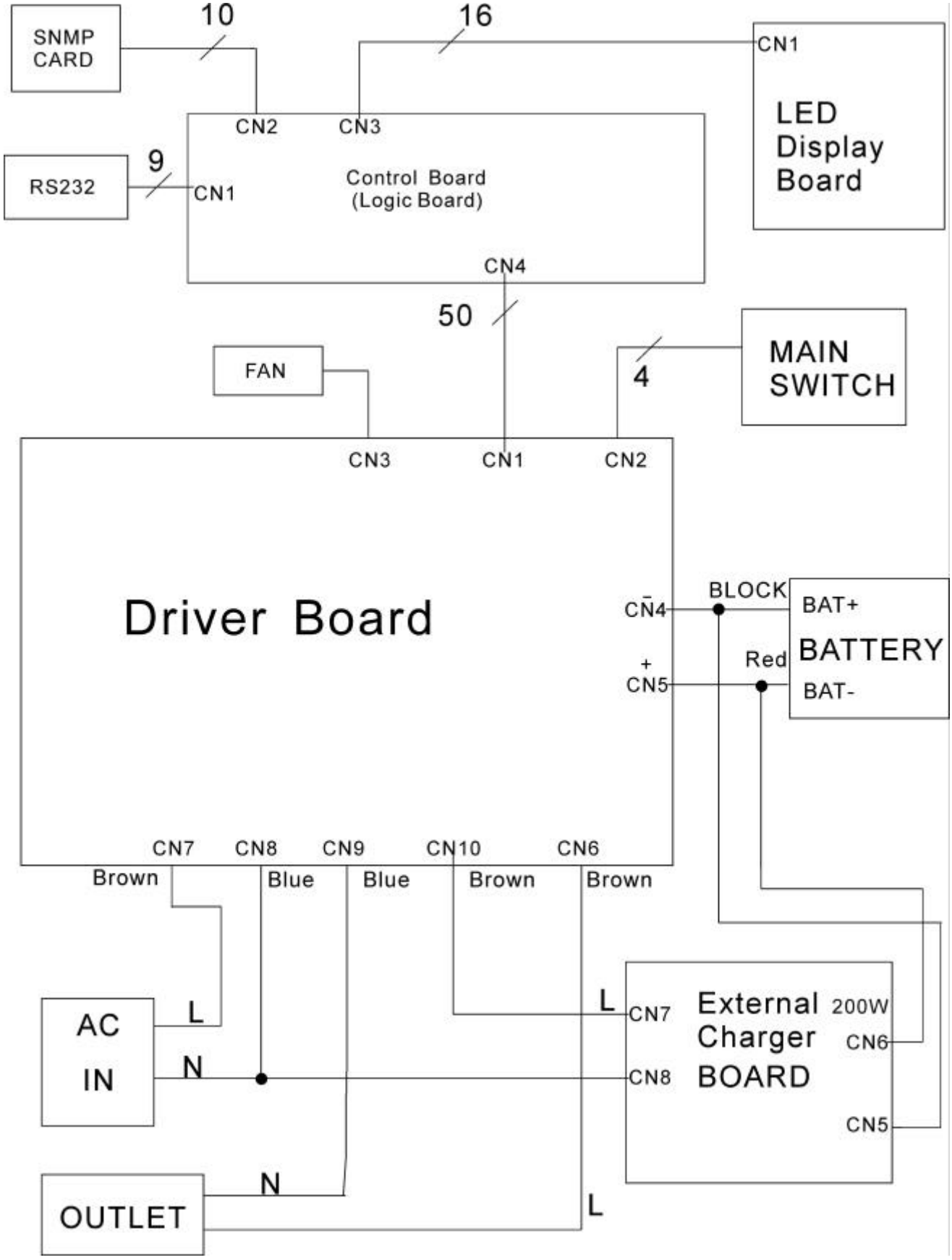
6.7 Quick trouble shooting



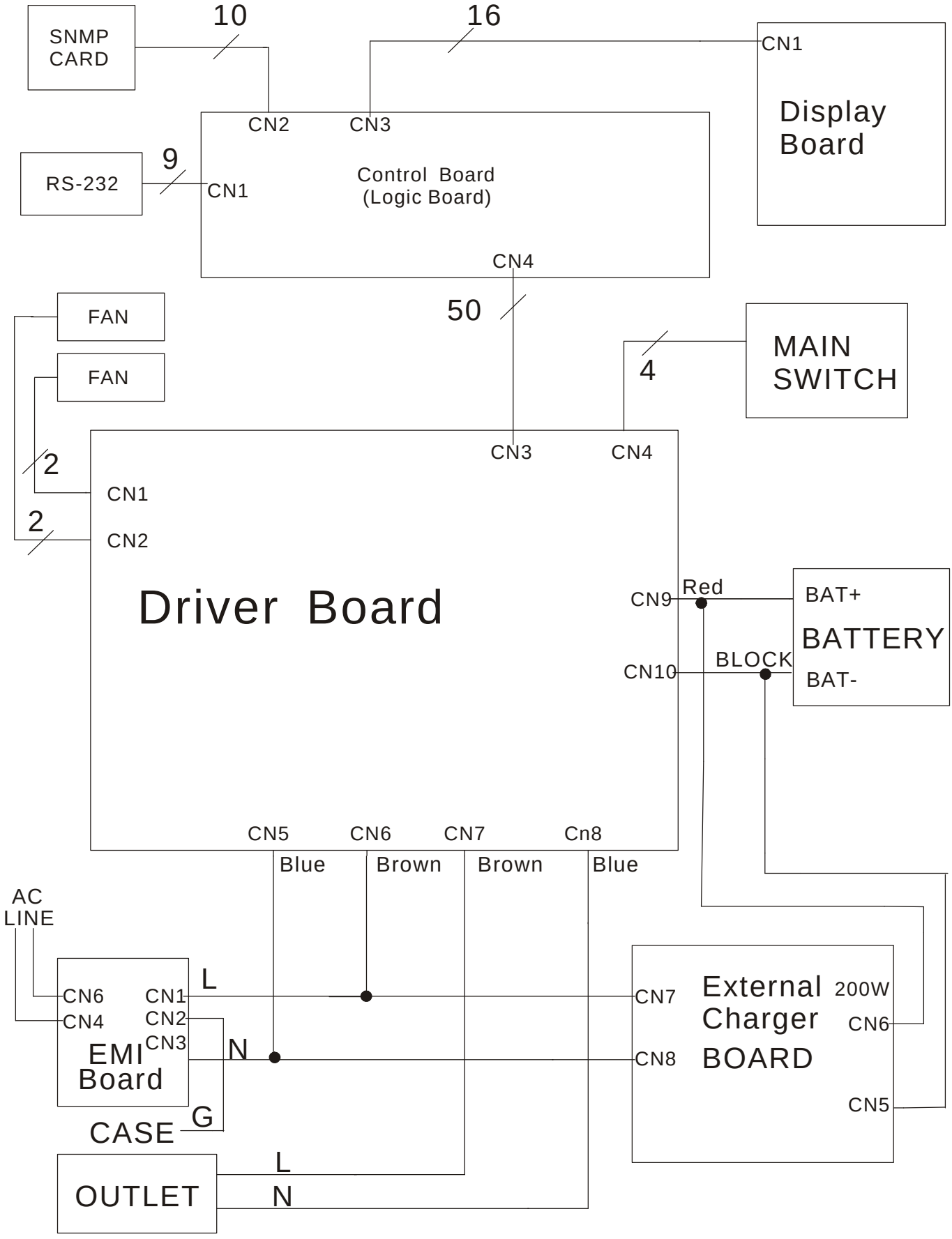
Appendix

a.1. Wiring Diagram

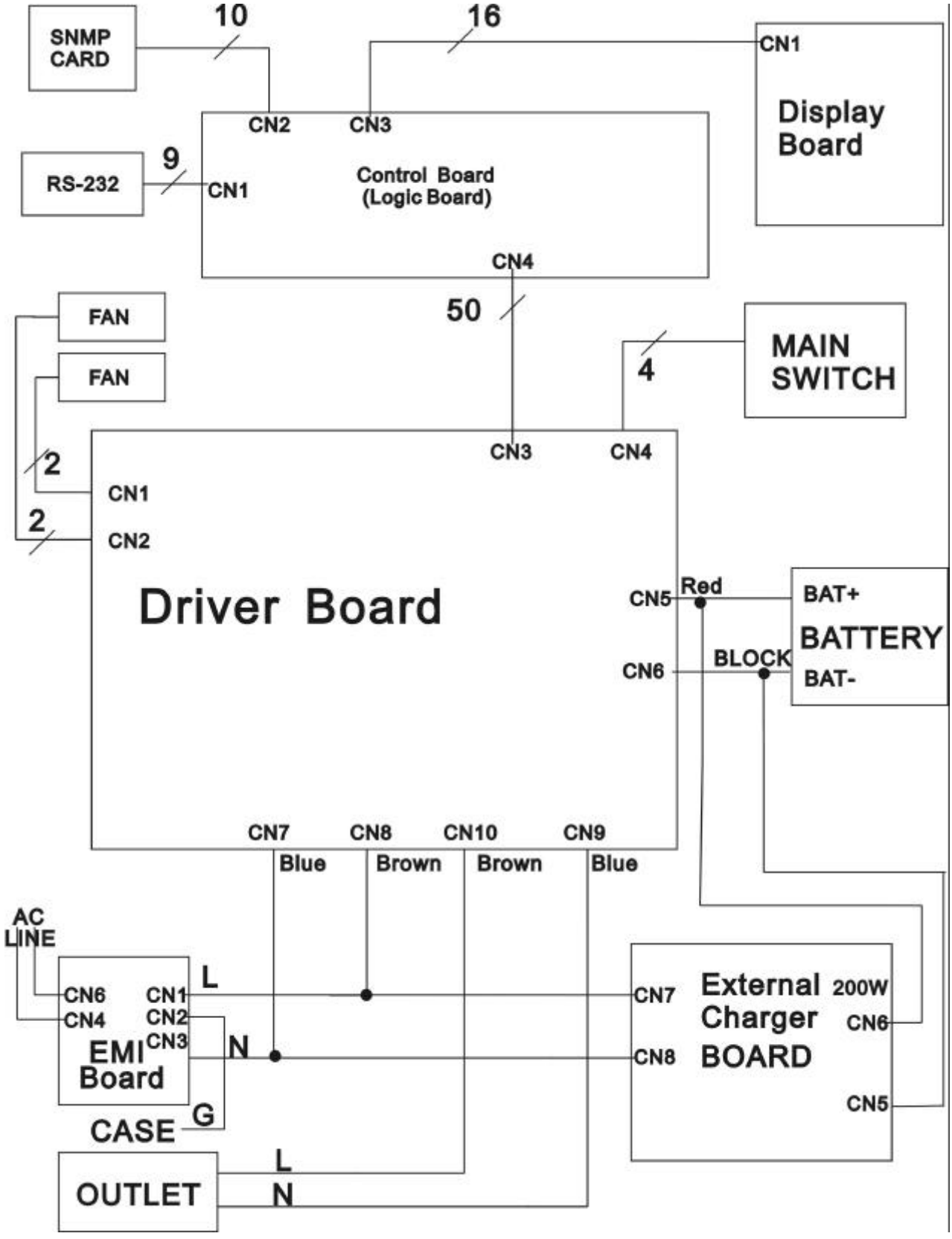
a.1.1 For MS 1K



a.1.2. For MS 2K

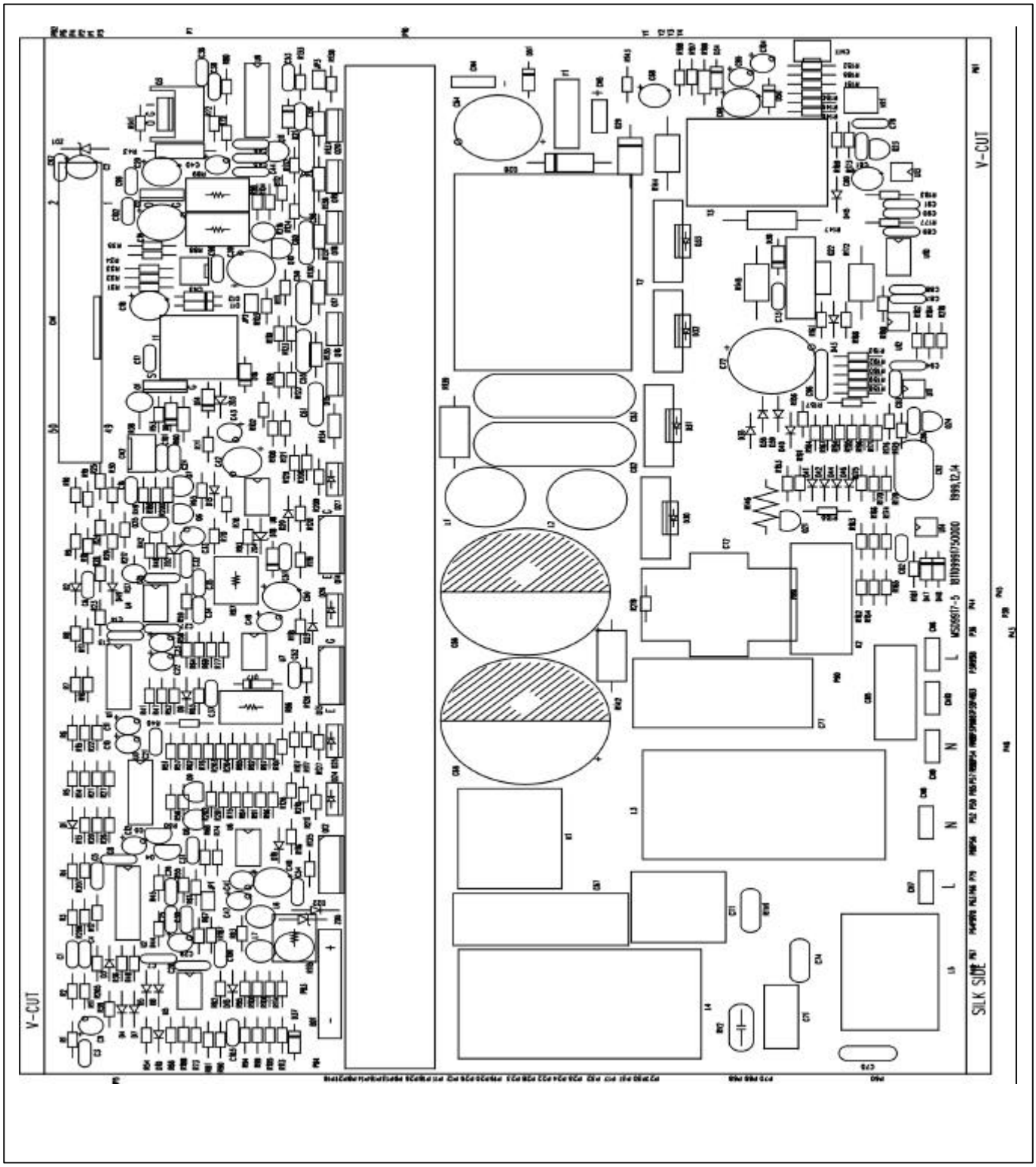

SNMP CARD
10
16
CN1
Display Board
CN2
CN3
RS-232
9
CN1
Control Board (Logic Board)
CN4
50
FAN
FAN
MAIN SWITCH
4
CN3
CN4
2
CN1
2
CN2
Driver Board
CN9
Red
BAT+
BATTERY
BLOCK
CN10
BAT-
CN5
CN6
CN7
Cn8
Blue
Brown
Brown
Blue
AC LINE
CN6
CN4
CN1
CN2
CN3
EMI Board
L
N
G
CASE
CN7
CN8
External Charger BOARD
200W
CN6
CN5
OUTLET
L
N

a.1.3. For MS3K

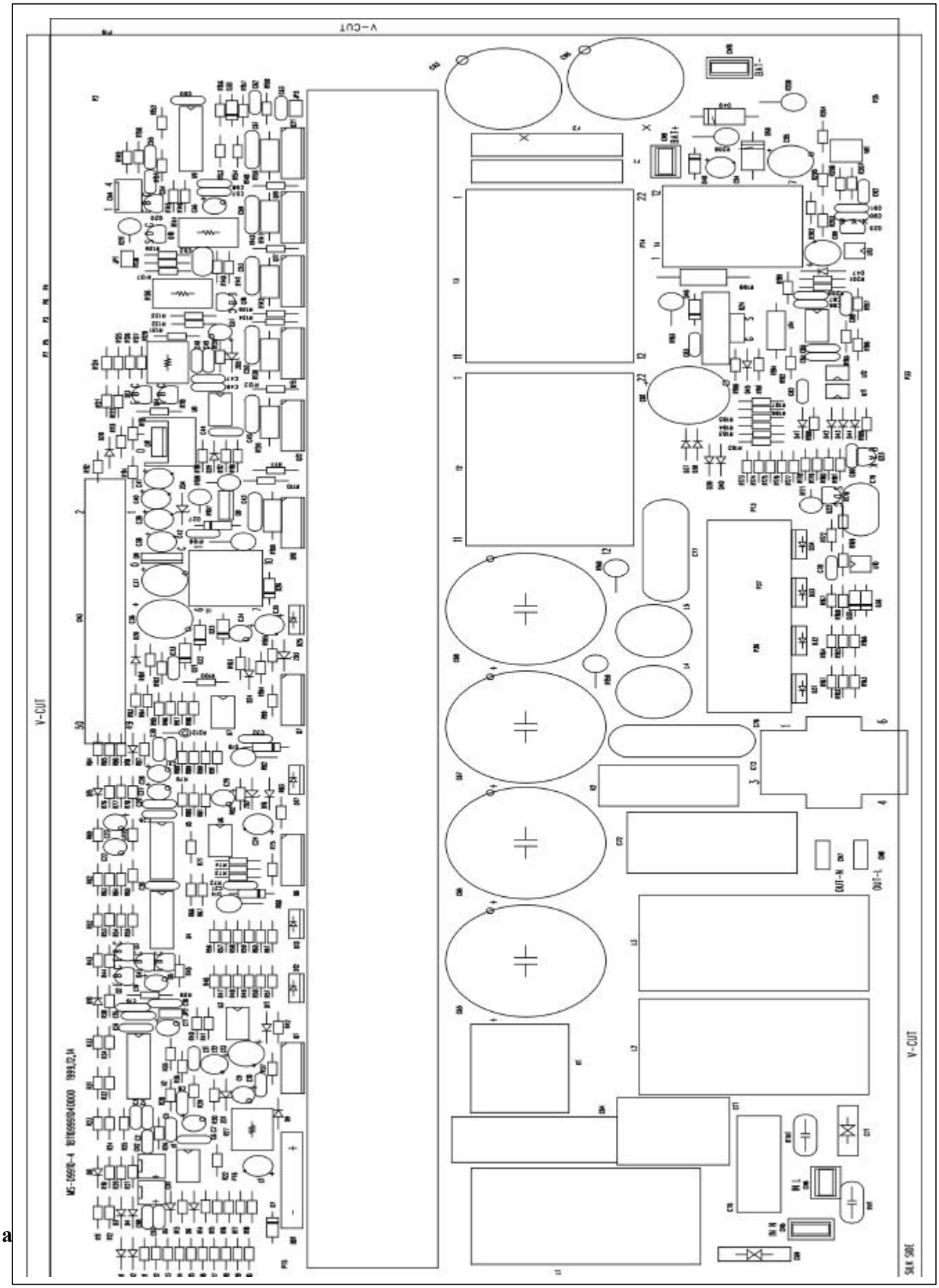

SNMP CARD
10
16
CN1
Display Board
CN2
CN3
RS-232
9
CN1
Control Board (Logic Board)
CN4
50
FAN
FAN
4
MAIN SWITCH
CN3
CN4
2
CN1
2
CN2
Driver Board
CN5
Red
BAT+
BATTERY
BLOCK
CN6
BAT-
CN7
CN8
CN10
CN9
Blue
Brown
Brown
Blue
AC LINE
CN6
CN4
CN1
CN2
CN3
EMI Board
L
N
G
CASE
OUTLET
L
N
CN7
CN8
External Charger BOARD
200W
CN6
CN5

a.2. Placements

a.2.1 For MS1K /220V

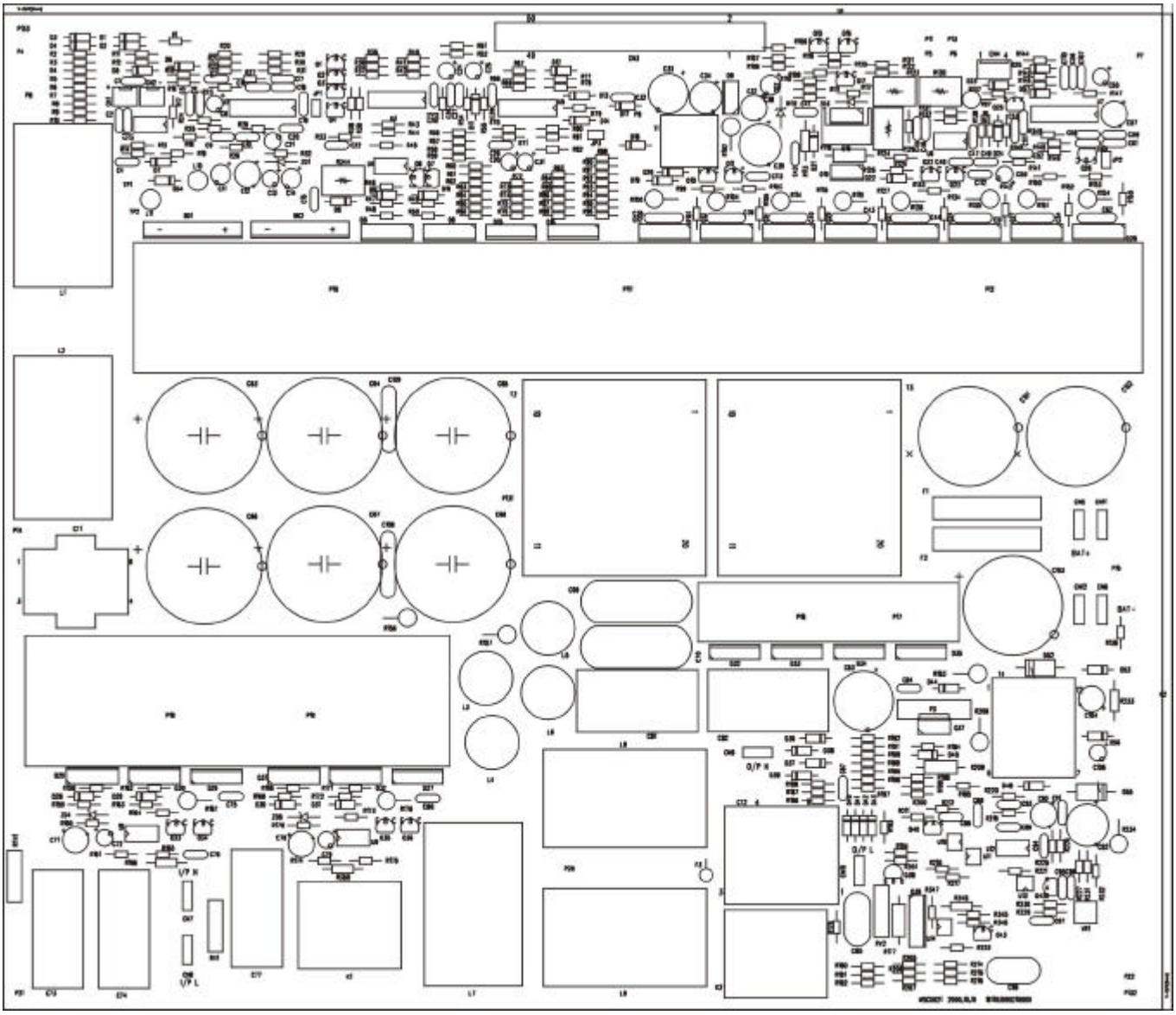


a.2.2 For MS2K/220V

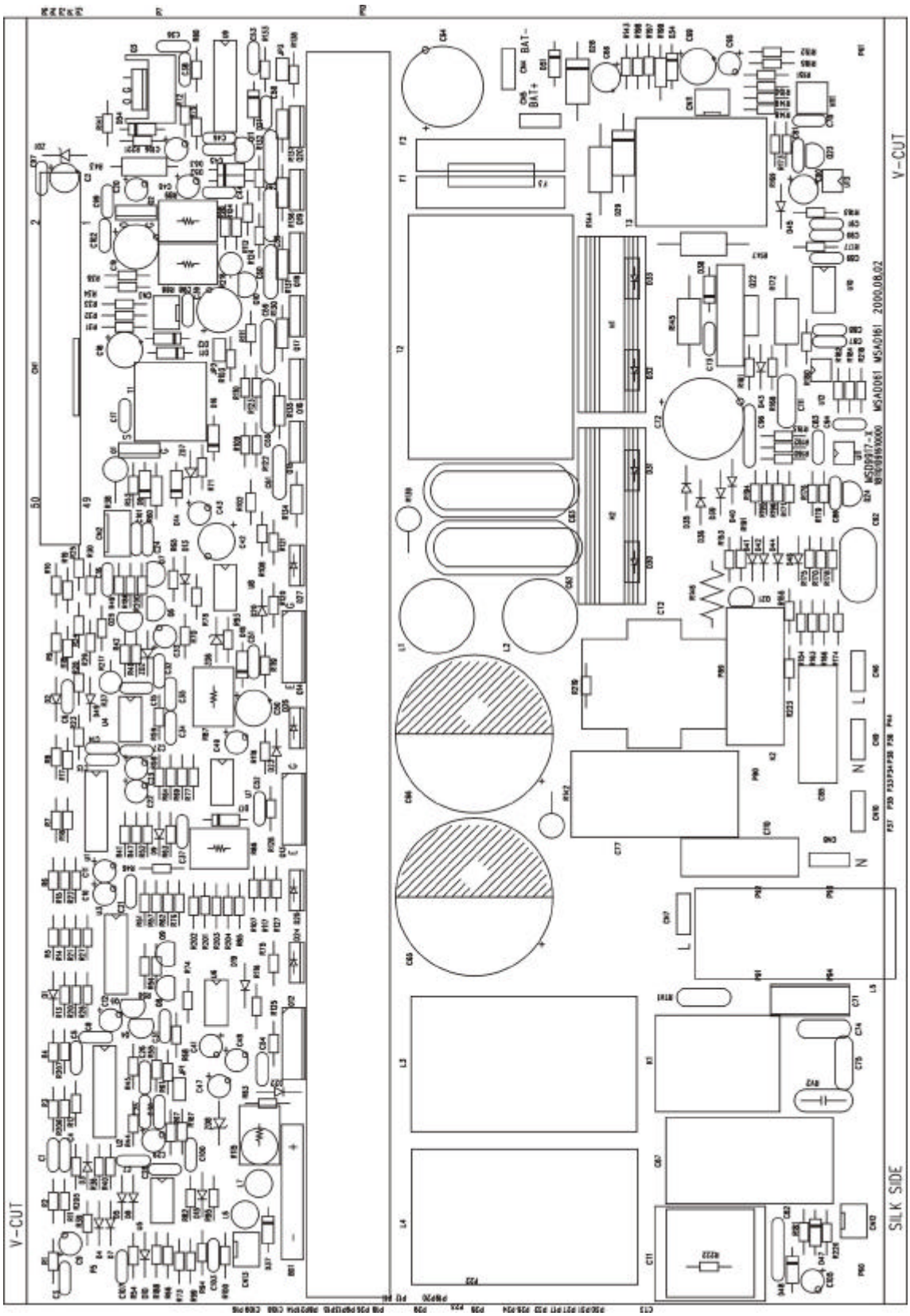


a

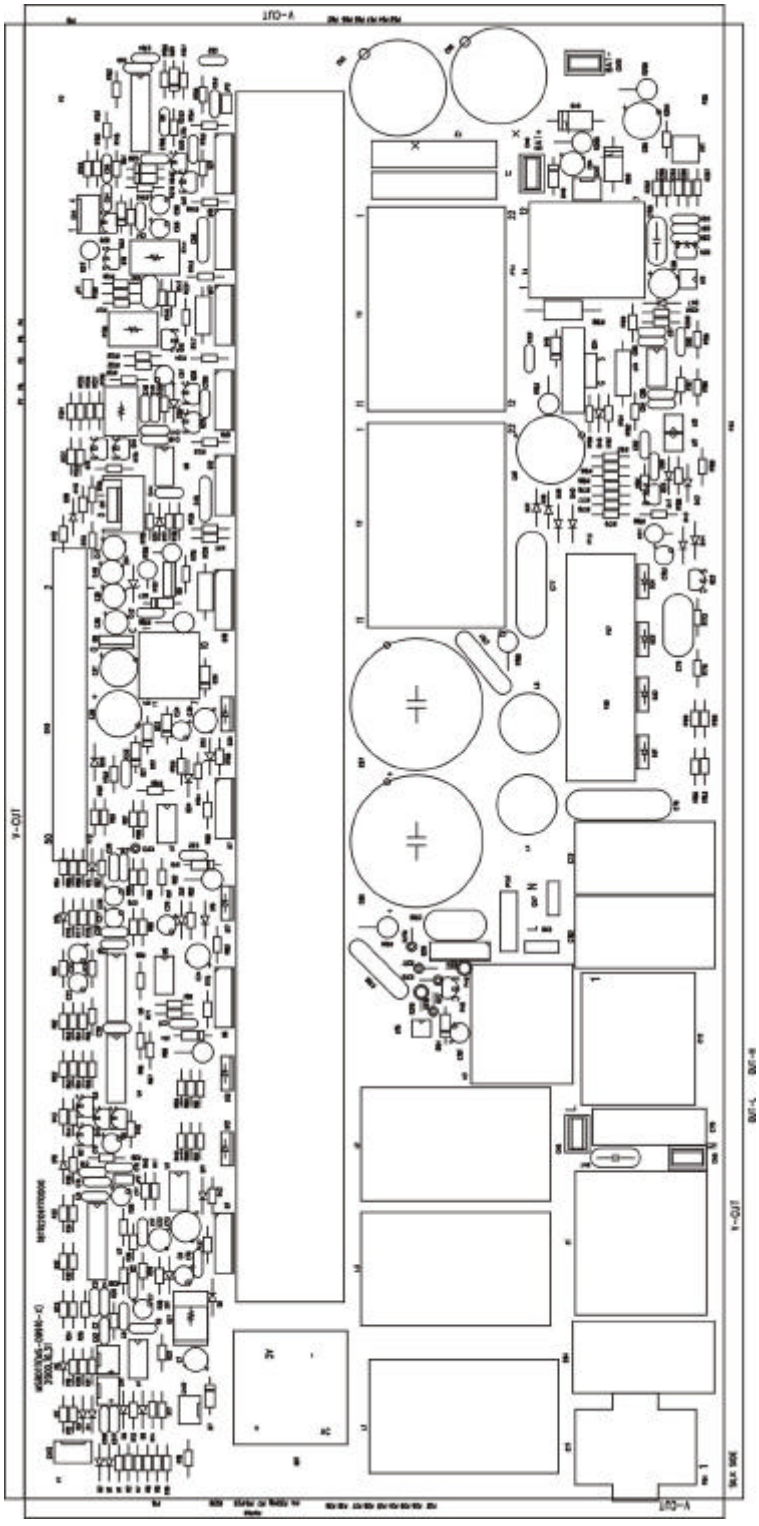
a.2.3 For MS3K/220V



a.2.4 For MS1K/120V



a.2.5 For MS2K/120V



a.2.6For MS3K/120V